

AUSTRALIAN SPECIES OF ARISTEIDAE AND BENTHESICYMIDAE  
(PENAEOIDEA: DECAPODA)

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Twelve species of Aristeidae from Australian seas, representing all genera in the family, have been identified (\*indicates new records): *Aristaeomorpha foliacea*, *Aristaeopsis edwardstana*, \**Aristeus mahahissae*, *A. virilis*, *Austropenaeus nitidus*, \**Hemipenaeus carpenteri*, \**Hepomadus tener*, \**Parahepomadus vaubani*, \**Plesiopenaeus armatus*, \**P. coruscans*, \**Pseudaristeus kathleenae*, \**P. sibogae*. (*Aristeus semidentatus* has also been recorded from Australia, but its identity could not be confirmed in existing museum collections). In the Benthescymidae ten species have been identified; *Benthescymus investigatoris*, *B. urinator*, *Gennadas haueri*, *G. capensis*, *G. gilchristi*, *G. incertus*, *G. kempfi*, *G. propinquus*, *G. scutatus*, *G. thayeri*, plus a new subspecies *Benthescymus urinator howensis*. Definitions of the 2 families and the genera represented, with keys, are included. Keys to the Indo-West Pacific species are given, together with diagnoses of the Australian species. Zoogeography of the 2 families is discussed briefly □ *Indo-West Pacific, Aristeidae, Benthescymidae, Australia, diagnoses, distribution, zoogeography.*

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Up to the late 19th century all penaeoid decapods were included in the Penaeidae. It was recognised, however, that there were major differences between some groups and Wood-Mason (1891) identified 3 distinct deep-water groups in the Penaeidae: Aristeina, Benthescymina and Solenocerina. Later, the Aristeina was raised to family status to include the Aristeinae, Benthescyminae and Solenocerinae. These 3 sub-families have been raised to family level within the Penaeoidea (Pérez Farfante & Kensley, 1997). Thus there are now 5 families within this super-family, distinguished as follows.

KEY TO THE FAMILIES OF THE  
PENAEOIDEA

1. Postorbital\* spine present . . . . . Solenoceridae  
Postorbital spine absent . . . . . 2
2. Third to fifth pleopods uniramous . . . . . Sicyoniidae  
Third to fifth pleopods biramous . . . . . 3
3. Dorsal rostral teeth plus postrostral teeth 0-2, rarely 3; rostrum truncate; deep and ranging from short of, to barely exceeding the cornea; adrostral carina absent; antero-ventral carapace usually emarginate . . . . . Benthescymidae  
Dorsal rostral teeth plus postrostral teeth more than 2; rostrum usually well exceeding the cornea; adrostral carina usually present; antero-ventral region of the carapace not deeply emarginate . . . . . 4
4. Upper antennular flagellum much shorter than the lower and attached laterally to the third segment of the antennular peduncle; prosartema reduced to a setose knob . . . . . Aristeidae

Upper antennular flagellum of similar length to the lower and attached apically to the third segment of the peduncle; prosartema well developed and foliaceous . . . . . Penaeidae

\* In some solenocerid genera this could be identified as a postantennal spine. In the Aristeidae *Parahepomadus* has a postantennal spine, but the antennular flagella and long rostrum with only three teeth readily distinguish it from the Solenoceridae.

Twentyseven species of Solenoceridae have been identified from Australian seas (Dall, 1999), but although several species of Aristeidae are common in deeper water commercial prawn trawls, only 13 Australian species are described in this paper. The Benthescymidae are small and delicate and few were in the collections of Australian museums until the advent of extensive investigations using mid-water trawls, which collected 8 *Gennadas* species from Australian seas. While the Solenoceridae largely inhabit the continental slope, the Aristeidae are mostly found from the lower slope into deeper water, exceptionally down to 5,000m. Some Benthescymidae are mesopelagic or bathypelagic, others are benthic, often at depths below 1,000m.

Key taxonomic papers on the Aristeidae and Benthescymidae are by Crosnier (1978, 1985), Crosnier & Forest (1973), Kensley (1971), Kensley et al. (1987), Kikuchi & Nemoto (1991), Pérez Farfante (1973, 1987), Pérez Farfante & Kensley (1997). Most of these publications and others describe specimens from outside

Australian waters. This paper therefore attempts to cover the Australian species in sufficient detail to facilitate their identification by non-specialists. Definitions are given of the families and genera, with keys. Species keys include known Indo-West Pacific species, because it is likely that, in the future, some additional species will be found in Australian seas. The species diagnoses and figures are from specimens in the collections of the Australian (AM), Northern Territory (NT), Queensland (including Museum of Tropical Queensland) (QM), Tasmanian (TMH) and Victorian (MV) Museums and the CSIRO Marine Laboratories, Hobart. Generally synonymies are restricted to primary and key references, especially where the commoner species, such as *Aristaeomorpha foliacea* have a very extensive synonymy. General taxonomic features of the carapace and appendages are identified in Grey et al. (1983) or in Dall et al. (1990). The special taxonomic features of the Solenoceridae Dall (1999) are also applicable to the Aristeidae and Benthescymidae, except for the nomenclature of the anterior branchiostegal region. In the Benthescymidae the anterior end of the branchiostegal emargination is often marked by an angular projection, the infra-antennal angle. Also, all members of both families have, near or on the margin of the carapace, a branchiostegal spine, which is continuous with a carina of varying length. It is similar to the hepatic carina of other families, particularly when it extends past the lower end of the cervical sulcus. In many other species it stops well short of this region and could equally be called a branchiostegal carina. For the sake of uniformity it will be described here as an hepatic carina.

*Length.* Except when scale bars are included in figures, lengths are carapace length (CL) i.e. distance between the posterior rim of the orbit

and the midline of the posterior rim of the carapace.

SYSTEMATICS

Superfamily PENAEOIDEA  
Family ARISTEIDAE Wood-Mason, 1891

*Aristaeina* Wood-Mason, 1891: 278.  
*Aristaeinae* Alcock, 1901: 27; Ramadan, 1938: 36; Kubo, 1949: 193.  
*Aristeinae* Bouvier, 1908: 6, 13; Balss, 1957: 1516; Crosnier, 1978: 14.  
*Aristeidae* Crosnier, 1978: 14; De Freitas, 1985: 3; Squires, 1990: 20; Pérez Farfante & Kensley, 1997: 32.  
*Aristaeidae* Grey et al., 1983: 14; Dall et al., 1990: 58.

**DIAGNOSIS.** Rostrum usually elongate, apparently sexually dimorphic in some genera, being shorter in adult ♂♂; with 3 or more dorsal teeth, without ventral teeth. Antennal and branchiostegal spines always present, postorbital and pterygostomial spines absent; postantennal and hepatic spines rarely present, cervical sulcus variable, sometimes reaching the dorsum, sometimes weak and restricted to the lateral surface of the carapace; postcervical sulcus sometimes present. Abdominal somites 4-6 always carinate, somite 3 sometimes carinate; telson apically acute with 3 or 4 pairs of movable lateral spines. Optic peduncle with a mesial tubercle, optic scale absent. Prosartema reduced to a setose boss; antennular flagella unequal, the dorsal flagellum very short and flattened and inserted proximally into the third segment; ventral flagellum long and sexually dimorphic in some genera; maxillulary palp unsegmented. Exopods on all maxillipeds, present or absent on pereopods; pereopods 4 & 5 usually more slender and longer than pereopod 3. Pleopods well developed, sometimes longer than the carapace. Petasma simple, open; second male pleopod with appendix masculina consisting of inner and outer projections (sometimes referred to as appendix

TABLE 1. Distribution of branchiae and epipods on thoracic somites of Aristeidae. \* s = small; r = rudimentary.

Genus	Pleurobranchs Somites 3-8	Arthrobranchs Somite 1	Arthrobranchs Somite 2	2 Arthrobranchs Somites 3-7	Podobranchs Somites 2-5	Epipods Somites 1-7
<i>Aristaeomorpha</i>	+ (3 s)*	s	s, 1	+	+ (also 6)	+
<i>Aristaeopsis</i>	+	1	s, 1	+	+ (also 6)	+
<i>Aristeus</i>	+ (s or r, 3-7)	1	s, 1	+	+	1-6 only
<i>Austropenaeus</i>	+	1	s, 1	+	+ (also r on 6)	+
<i>Hemipenaeus</i>	+	1	s, 1	+	+	+ (r on 7)
<i>Hepomadus</i>	+	1	r, 1	+	+	+ (r on 7)
<i>Parahepomadus</i>	+	1	s, 1	+	+	+ (s on 7)
<i>Plesiopenaeus</i>	+	s	s, 1	+	+ (also 6)	+ (s on 7)
<i>Pseudaristeus</i>	+	r	s, 1	+	+	1-6 only

interna and appendix masculina, respectively) and no distolateral projection. Thelycum open, seminal receptacle deep; thoracic somite 7 with a shield-like median plate. The arrangement of branchiae and epipods of the genera of the Aristeidae are listed in Table 1.

REMARKS. Pérez Farfante (1987) concluded that the relative length of the rostrum in some genera is size dependent as well as being sexually dimorphic. The prevailing view is that this is true sexual dimorphism and not due to an earlier breakage of this structure, which is often more slender in ♂♂, followed by regeneration of a new tip. (Some adult ♀♀ also show evidence of such a regeneration).

The family as now defined, is very homogeneous and consists of 9 genera, all of which have been recorded from Australian seas. *Aristeomorpha* stands a little apart from the other genera: with 6-11 fairly evenly spaced dorsal rostral teeth; basicerite with a prominent spine (like that in other penaeoid families); petasomal halves diverging distally and ventral costa attached along its length; and thoracic 8 sternite of the thelycum with a short rounded median prominence. The remainder are similar in appearance and some are difficult to distinguish, sometimes relying on rather minor features of the cephalothorax or abdomen. For example, the rudimentary exopods (Fig. 1) which separate 2 groups of 3 genera each are often difficult to detect. Unfortunately, better criteria do not seem to exist. Also, the trend in taxonomy of the Aristeidae has been to create small genera. Thus of the 9 genera 4 are monospecific, 2 contain 2 species and 1 includes 3. A revision of the family is perhaps needed at this stage and certainly before any new genera are created.

KEY TO GENERA OF THE ARISTEIDAE

1. Hepatic spine present . . . . . 2  
 Hepatic spine absent . . . . . 3
2. Three dorsal rostral teeth, including the postrostral (epigastric) tooth. . . . . *Hepomadus*  
 More than three dorsal rostral teeth, including the postrostral tooth. . . . . *Aristeomorpha*
3. Postantennal spine present . . . . . *Parahepomadus*  
 Postantennal spine absent . . . . . 4
4. Exopods absent from all pereopods . . . . . 5  
 Exopods (usually reduced or rudimentary, Fig. 1) present on all pereopods . . . . . 7
5. A sub-distal meral spine present on pereopods 1 & 2; scaphocerite in male not modified. . . . . 6  
 No meral spines on pereopods 1 & 2; scaphocerite in male distally elongate . . . . . *Aristeopsis*

6. Cervical sulcus distinct and extending to the dorsum of the carapace; postcervical sulcus present. . . . . *Pseuduristeus*  
 Cervical sulcus reduced to a very short sulcus in the hepatic region; postcervical sulcus absent . . . . . *Aristeus*
7. Abdominal somite 3 carinate; epipod on pereopod 4 rudimentary . . . . . *Hemipenaeus*  
 Abdominal somite 3 not carinate; epipod on pereopod 4 large . . . . . 8
8. Podobranchia on pereopod 3 rudimentary; carinae on the carapace weak; ventral antennular flagellum and dactyl of the third maxilliped modified in the male . . . . . *Austropenaeus*  
 Podobranchia on pereopod 3 large; carinae on the carapace well defined; ventral antennular flagellum and dactyl of the third maxilliped not modified in the male . . . . . *Pleustopenaeus*

**Aristeomorpha** Wood-Mason, 1891

*Penaeus* Risso, 1827: 69 [part]; H. Milne-Edwards, 1837: 418 [part].  
*Aristeus* Bate, 1881: 189; 1888: 317 [part].  
*Aristeomorpha* Wood-Mason, 1891: 286; Anderson & Lindner, 1943: 301; Kubo, 1949: 200; Crosnier, 1978: 52; Hayashi, 1983b: 280; de Freitas, 1985: 15; Liu & Zhong, 1986: 33; Pérez Farfante & Kensley, 1997: 33.  
*Aristeomorpha* Senna, 1903: 268; Bouvier, 1908a: 52; Ramadan, 1938: 53.

DIAGNOSIS. Integument finely pubescent, with a pair of large ventral photophores on the thoracic and abdominal somites with a pattern of smaller photophores on the ventral surface, the scaphocerites, external uropods and most of the other appendages. Rostrum reaching well beyond the scaphocerite in females and juveniles, usually shorter than the antennular peduncle in adult ♂♂; with 5-9 dorsal teeth in all; adrostral carina reaching between the first and second rostral teeth; postrostral carina low and reaching about half the carapace. Antennal and branchiostegal spines present, the latter on the margin of the carapace with a carina extending almost to the hepatic spine; hepatic spine large,

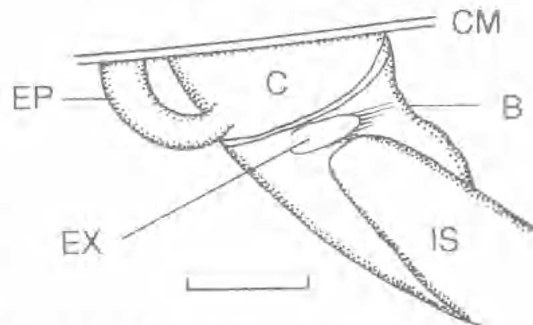


FIG. 1. Rudimentary exopod on basis of pereopod 3 of *Austropenaeus nitidus* (de Man, 1911). AM P53936, 34°49'S 151°14'E, 1225 m, ♀, 33 mm. B, basis; C, coxa; Ep, epipod; Ex, rudimentary exopod; IS, ischium; CM, margin of carapace. (Scalebar = 1 mm).

cervical sulcus reaching about halfway to the dorsum. A deep sulcus extends from a shallow emargination below the branchiostegal spine to its junction with the hepatic sulcus, which turns ventrad at the mid-carapace; hepatic carina short and blunt; branchiocardiac carina prominent, the sulcus

shallow, the carina extending from the divergence of the hepatic sulcus almost to the posterior margin of the carapace. A low carina, sometimes barely visible, on the posterior two thirds of abdominal somite 3, 4-6 fully carinate, all 4 somites ending in a sharp spine. Telson with 4 pairs of small lateral movable spines. Eye large; stylocerite reaching about 0.75 the first segment of the antennular peduncle. Dorsal antennular flagellum flattened with terete tip, slightly longer than the third antennular segment, ventral flagellum long, not modified in the male. Lateral spine of the scaphocerite at about 3/4 the length of the lamella; scaphocerite not modified in the male. Pereopods without exopods or ischial and meral spines; pereopod 3 with a large podobranch. Ptasma simple with diverging apices; thelycum with a deep hemicylindrical receptacle, formed by a shield-like anterior plate on thoracic somite 7, the rounded apex directed anteroventrally, the coxae of the pereopod 5 and a rounded median boss on somite 8.

**REMARKS.** Armature of the rostrum sets *Aristaeomorpha* apart within the family. The 2 species, *A. foliacea* (Risso, 1827) and *A. woodmasoni* Calnan, 1925, are distinguished by the relative depths of the pterygostomian area, the length/depth ratios being 3.5-4.0 and <2.5, respectively. Other features are minor (relative lengths of the uropods and dactyls of the fourth and fifth pereopods). Barnard (1950) pointed out that Kemp & Scwell (1912) could find no differences in the petasmas and thelyca of the 2 species. *A. woodmasoni* has so far been recorded only from Indian waters and its specific status needs to be re-examined as *A. foliacea* has been recorded from the Maldivic Islands, Sri Lanka, Indonesia and surrounding seas.

While *Aristeus* and possibly other members of this family have photophores, at least on the appendages, *A. foliacea* appears to be the most luminescent (Crosnier, 1978: 57, fig 23e-f, for

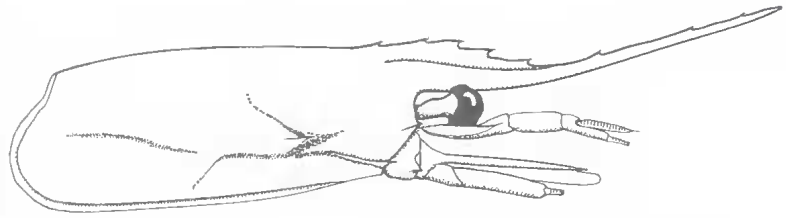


FIG. 2. *Aristaeomorpha foliacea* (Risso, 1827) QMW10091, 26°20'S, 153°53'E, 300m, ♀, 42mm.

full description). It is widely distributed (Crosnier, 1978 listed 99 references in his 'Bibliographie partielle') and occurs in deeper-water prawn fisheries, including SE Australia.

***Aristaeomorpha foliacea* (Risso, 1827)**  
(Fig. 2)

- Penaeus foliacea* Risso, 1827: 69, pl. 2, fig. 6; Milne-Edwards, 1837: 418; Miers, 1878: 307.  
*Aristeus rostridentatus* Bate, 1881: 189; 1888: 317, pl. 51.  
*Aristaeomorpha Giglioliana* Wood-Mason, 1892: pl. 2, fig 2.  
*Aristaeomorpha foliacea* (see Crosnier, 1978 for bibliography prior to 1976); Crosnier, 1978: 54, fig. 23: 1984: 21; 1985: 861; 1989: 42; 1994b: 369; Hayashi, 1983b: 280, fig. 53; Grey et al., 1983: 46, pl. 1; de Freitas, 1985: 16, fig. 11-7; Liu & Zhong, 1986: 33, figs 12, 13; Kensley et al., 1987: 279; Hanamura, 1989: 51.

**MATERIAL.** QM W10091, 26°20'S 154°E, 300m, ♂, 43mm, 2♀, 42, 43mm; QMW11428, 23°46'S 153°E, 550m, ♂, 40mm, 3♀, 44, 44, 46mm; QMW14351, 26°30'S 153°45'E, 390m, ♂, 43mm, ♀, 40 mm; QMW15292, 28°S 153°54'E, 550m, 2 ♂, 28, 35mm, ♀, 42mm.

**DIAGNOSIS.** Apart from the differences in pterygostomian depths of the 2 species noted above, the genus diagnosis is also the specific definition.

**Colour.** Uniformly deep pink to wine red (colour plate in Grey et al., 1983).

**DISTRIBUTION.** E Australia and Tasmania, 18°-42°42'S, the western approaches to Bass Strait, Great Australian Bight, Arafura Sea, 8°34'S 131°E, through the Northwest Shelf to 28°S on the west coast; 250-700 m on mud to muddy sand. Thus it is likely to occur at these depths all round Australia. Known range: cosmopolitan, Indian Ocean from SW and E Africa, Madagascar, Réunion, Maldivic Islands, Sri Lanka, Indonesia, Philippines, China Sea, Japan, Australia, New Zealand, New Caledonia, Wallis and Futima Islands, Fiji, W Atlantic Ocean, from Massachusetts to Venezuela, Mediterranean Sea, E Atlantic Ocean from Bay of Biscay to Rio de Oro. Depth range 170-810m,

although exceptionally caught up to 61m. Crosnier (1978) suggested that there may be a diurnal migration from deep to shallower water at night.

#### *Aristaeopsis* Wood-Mason, 1891

*Aristaeopsis* Wood-Mason, 1891: 282; Bouvier, 1908: 61; Burkenroad, 1936: 94 [part]; Crosnier, 1978: 86; Pérez Farfante & Kensley, 1997: 36.

*Plesiopenaeus* Faxon, 1895: 199 [part]; Milne-Edwards & Bouvier, 1909: 200 [part]; Burkenroad, 1936: 94 [part]; Ramadan, 1938: 49; Barnard, 1950: 621 [part]; Crosnier, 1978: 85 [part]; Squires, 1990: 41. (non *Plesiopenaeus* Bate, 1881).

*Aristaeus* (*Plesiopenaeus*) Alcock, 1901: 35 [part].

*Aristeopsis* de Man, 1911: 6.

**DIAGNOSIS.** Integument glabrous, carapace firm. Rostrum with unarmed tip upcurved, as long as the carapace in ♀♀ of 30mm CL, decreasing to around 0.55 of the carapace at 62mm CL, not sexually dimorphic although often damaged in ♂♂; with 3 dorsal rostral teeth; adrostral carina not quite reaching the first rostral tooth; postrostral carina low, but reaching about 0.8-0.9 the carapace. Antennal spine with a well-defined carina; hepatic spine absent; branchiostegal spine on the margin of the carapace and continuous with a prominent carina running almost to the branchiocardiac carina; hepatic sulcus deep, occupying three-quarters the posterior part of the carina and descending to the submarginal carina. Gastro-orbital carina prominent, extending from just behind the orbit almost to the upper end of the prominent cervical carina; cervical sulcus deep in the lower part, but barely defined in the upper half, where it sometimes meets the dorsum; branchiocardiac carina and sulcus prominent and reaching the posterior margin of the carapace; two irregular carinae running from the cervical carina to the branchiocardiac sulcus. A dorsal carina beginning on the posterior quarter of abdominal somite 2 and continuing to somite 6, abdominal somites 3-6 each with a sharp carina and each ending in a prominent spine; telson with four pairs of small movable spines. Dorsal antennular flagellum short, flattened; ventral flagellum long, tapering and not modified in the male; scaphocerite in the adult male with an elongate distal projection, ovate in cross section, and sub-equal in length to the lamellar part. Pereopods without exopods, pereopod 3 with podobranchia;

pereopods 1 & 2 without distal movable ischial and meral spines. Petasma with dorsal lobule and median lobes of similar length, the ventral costa forming a projecting median hook. Thelycum with an acute anteriorly pointed prominence on thoracic somite 7, the posterior part forming a rounded hollow; eighth somite with a bluntly pointed median prominence. Uniformly scarlet to deep crimson

**REMARKS.** *Aristaeopsis* was originally created for *Penaeus edwardsianus* by Wood-Mason & Alcock (1891b), but Faxon (1895) synonymised it with *Plesiopenaeus* Bate, 1881 and this usage has persisted for most of the 20th century. Burkenroad (1936) recognised 4 species of *Plesiopenaeus* (*P. edwardsianus*, *P. armatus*, *P. coruscans* and *P. nitidus*). Although accepting this classification, Crosnier (1978, table 11) listed a number of differences between *P. edwardsianus* and *P. nitidus* and the other 2 species. For *P. edwardsianus* the most important of these are lack of exopods on all pereopods; a dorsal carina and posterior spine on abdominal somite 3; the modified scaphocerite in ♂; absence of movable distal meral spines on pereopods 1 & 2. Pérez Farfante & Kensley (1997) considered these differences merited the resurrection of *Aristaeopsis* (feminine gender) which thus contains only *A. edwardsiana*. *Plesiopenaeus edwardsianus* has been extensively cited in the literature (Crosnier, 1978 listed 50 references) and because of long familiarity the general recognition of *A. edwardsiana* will no doubt take some time.

#### *Aristaeopsis edwardsiana* (Johnson, 1867) (Fig. 3)

*Penaeus Edwardsianus* Johnson, 1867: 897.

*Aristeus Edwardsianus* Miers, 1878: 308, pl. 17, fig. 3.

*Aristeus coralinus* Bate, 1888: 32, fig 10.

*Aristaeopsis Edwardsiana* Wood-Mason & Alcock, 1891b: 283, figs 8-9; Wood-Mason, 1892: pl. I, figs 1,2; Alcock 1899.

*Aristaeopsis edwardsiana* Alcock & Anderson 1894: 147; Pérez Farfante & Kensley 1997: 37, fig. 7.

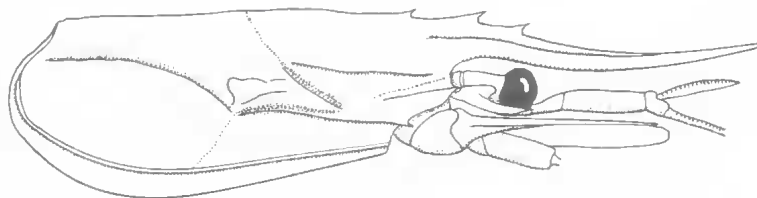


FIG. 3. *Aristaeopsis edwardsiana* (Johnson, 1867) AMP26776, 33°40'S, 151°56'E, 732m, ♀, 45mm.

*Plestopenaeus edwardsianus* Faxon  
1895 (for full synonymy to 1974  
see Crosnier, 1978: 88 ); Crosnier,  
1978: 88, figs 31a-c, 32a-c, 33a;  
Kensley et al. 1987: 281; Hayashi  
1983c: 368, fig. 59; Liu and Zhong  
1986: 43, fig. 17; Crosnier 1985:  
863; 1994b: 369; de Freitas 1985:  
20, fig. 2-9; Grey et al. 1983: 38,  
pl. 2.

MATERIAL. AM P26776, 33°40'S  
152°E, 732m, 2♂, 42, 53mm, 10♀,  
30-63mm, QMW 11307, 24°S  
153°E, 550m, 2♀, 38, 77;  
QMW11461, 23°34'S 153°E, 650m,  
♂ 48mm, 2♀ 64, 82mm;  
QMW15286, 28°S 154°E, 550m,  
3♂, 37, 41, 42mm, ♀, 57 mm;  
QMW15287, 28°S 154°E, 550m,  
3♂, 42, 44, 46mm, 2♀, 40, 50mm;  
W15291, 28°S 154°E, 550m, ♂,  
38mm.

DIAGNOSIS. As for genus.

REMARKS. *A. edwardsiana* occurs regularly in deep water prawn trawls off the Australian east coast, but at best is only of minor commercial importance. Crosnier (1978) reported that, off Madagascar, at the 700-800 depths preferred by the species, catches were barely 6-8 kg/h.

DISTRIBUTION. East coast of Australia, 17°-34°S, Arafura Sea 8°S 132°E, off Rowley Shoals, through the Northwest Shelf to 29°S 113°E; 200-1800 m on muddy substrates. Cosmopolitan, Indo-West Pacific Ocean from South Africa to the Arabian Sea, Bay of Bengal, Andaman Sea, Indonesia, South China Sea, Japan, Australia, Wallis and Futuna Islands; Western Atlantic Ocean from the Grand Banks to French Guiana, Eastern Atlantic Ocean from Portugal to the western Sahara, the Azores, Madeira and Canary Islands, 200-1850m.

#### *Aristeus* Duvernoy, 1840

*Penaeus* Risso, 1816: 96.

*Aristeus* Duvernoy, 1840: 217; Bate, 1881: 171, 187; 1888: 228, 240, 309; Senna, 1903: 261; Bouvier, 1908: 69; de Man, 1911: 27; Ramadan, 1938: 36; Crosnier, 1978: 60; Hayashi 1983a: 188; Liu & Zhong, 1986: 37; de Freitas, 1985: 3; Pérez Farfante & Kensley, 1997: 39.

*Aristaeus* Faxon, 1895: 197; Alcock, 1901: 27; Anderson & Lindner, 1943: 300; Kubo, 1949: 194.

*Aristaeus (Aristaeus)* Alcock, 1901: 29.

DIAGNOSIS. Integument glabrous or pubescent. Rostrum elongate, reaching well beyond the tip of the antennular peduncle in ♀♀ and young ♂♂, but usually shorter in adult ♂♂; with 3 dorsal teeth. Carapace with an antennal and a

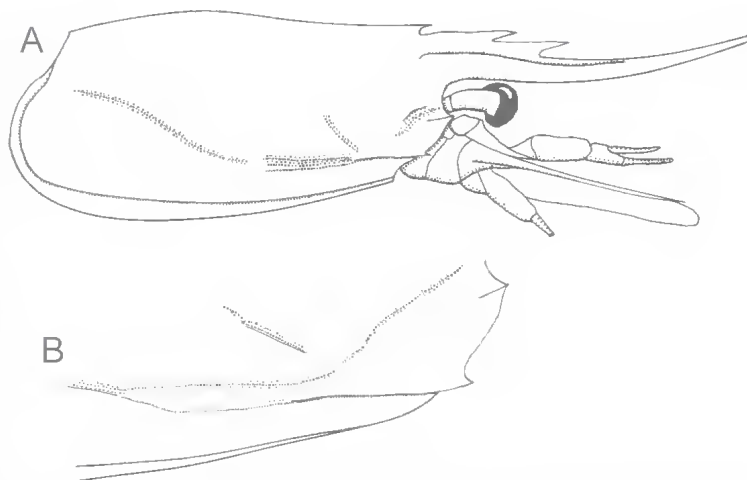


FIG. 4. A. *Aristeus mabahissae* Ramadan, 1938. AMP55934, 34° 53' S, 151° 15' E, 1116m, ♀, 37mm. B. *A. virilis* (Bate, 1881). NTCR006630, 8°39' S, 132°E, 540m, ♀, 39mm, anterior carapace showing long hepatic carina.

branchiostegal spine, the latter extending back as a carina, other spines absent; cervical sulcus marked only by a short lateral sulcus; branchiocardiac sulcus well-defined, the carina low. Only abdominal somites 4-6 with a distinct dorsal carina; telson with 4 pairs of movable lateral spines, apex acute. Cornea well developed, the peduncle with a prominent tubercle. Dorsal antennular flagellum short, flattened; ventral flagellum long, proximally sinuous in ♂. Pereopods without exopods; pereopods 1 & 2, and sometimes 3 with a movable subdistal meral spine; pereopods 4 & 5 slender; all pereopods with photophores.

Of 8 species known worldwide, 6 occur in the Indo-West Pacific. *A. antennatus* is also an Atlantic species together with *A. antillensis* and *A. varidens*. So far *A. mabahissae* and *A. virilis* have been collected only from Australian waters; *A. semidentatus* is a possible third; *A. antennatus* is listed in the Australian Museum collection, but could not be found at the time of writing and is not described below. Among the Indo-West Pacific species *A. virilis* is readily identifiable because of its finely tomentose integument and pereopods, the spine on the merus of pereopod 3 and a long carina extending posteriorly from the branchiostegal spine. The remaining glabrous species are difficult to distinguish, almost impossible unless the material is in a good state of preservation. Unusually for penaeoids, the genitalia are of limited use for identification; Crosnier (1978) notes that the colouration is identical for *A. antennatus*, *A. mabahissae* and *A.*

TABLE 2. Principal distinguishing features for identification of *Aristeus alcocki*, *A. antennatus*, *A. mabahissae*, *A. pallicauda*, *A. semidentatus*. \* P 1 = first pereopod.

Character	<i>A. alcocki</i>	<i>A. antennatus</i>	<i>A. mabahissae</i>	<i>A. pallicauda</i>	<i>A. semidentatus</i>
Length of *P 1 chela/length of carpus	1.15 - 1.25	1.3 - 1.48	1.07 - 1.25	1.41	1.0 - 1.06
Length of P 5 carpus/length of merus	1.08 - 1.18	1.00 - 1.14	0.98 - 1.06	1.24	1.28 - 1.34
Number of photophores on the carpus of P 5	?	65 - 117	4 - 8	36	14 - 21
Number of photophores on the propodus of P 5	?	73 - 98	8 - 13	31	17 - 25
A small spine on the posterior-dorsal edge of the third abdominal somite	Occasionally present	Always with a small spine	Occasionally present	Absent	Absent

*semidentatus*; the carapace is almost featureless, except for the earination behind the branchiostegal spine. Ramadan (1938) recommends using the ratios between various segments of the pereopods, but often these are not sufficiently different for reliable identification. Crosnier (1978) found that the number of photophores on pereopod 5 could be used as specific characters, at least in a given area; more recently, he has found that they are reliable for most of the Indo-West Pacific (Crosnier, 1994b, & pers. comm.). The red colour of the photophores fades with preservation, but in recently- and well-preserved specimens they may be seen by oblique light as a series of small circular structures. Unfortunately, the photophores are difficult, if not impossible to see in old and poorly preserved material, even if the slender pereopods 5 are present, which is often not the case. Crosnier (1978) recommended that a number of characters be taken in conjunction to distinguish species and the more useful are shown in Table 2. A key is also given, but unless the prawns are fresh, is mostly of value in preliminary identification.

KEY TO THE INDO-WEST PACIFIC SPECIES OF *ARISTEUS*

1. Body and pereopods finely pubescent. A subdistal mobile spine near the inferior border of the merus of pereopod 3 (P 3) . . . . . *A. virillis*  
 Body glabrous. No mobile spine on the merus of P 3 . . . . . 2
2. Ratio length of chela/length of carpus of P 1 approx. 1.0 . . . . . *A. semidentatus*  
 Ratio length of chela/length of carpus of P 1 greater than 1.0 . . . . . 3
3. A small posterior-dorsal spine on abdominal somite 3; number of photophores on carpus and propodus of P 5 greater than 60 . . . . . *A. antennatus*  
 Abdominal somite 3 usually without a spine; number of photophores on carpus and propodus of P 5 less than 60 . . . . . 4
4. Ratio length of chela/length of carpus of P 1 greater than 1.3; photophores on carpus and merus of P 5 greater than 20 . . . . . *A. pallicauda*  
 Ratio length of chela/length of carpus of P 1 less than 1.3; photophores carpus and merus of P 5 less than 20 . . . . . *A. mabahissae*

It was not possible to include *A. alcocki* Ramadan, 1938 in the key because the number of photophores on P 5 is not recorded in the literature. So far it appears to be limited to the Gulf of Aden, the Arabian Sea and the Bay of Bengal and thus may not occur in Australian seas. Similarly *A. pallicauda* Komai, 1993 is a rare species recorded only from northern Japan.

Although *A. semidentatus* has been recorded from Australian seas (Kensley et al., 1987), I was unable to confirm this with relevant specimens in the Australian Museum. Some were undoubtedly *A. mabahissae*, others were probably this species and the remainder were unidentifiable as *A. semidentatus*, these 2 species being similar. The criteria listed by Kensley et al. (1987) are in fact identical or very close to those of *A. mabahissae* (Crosnier, 1978) except for the ratio of the lengths of the carpus and merus of pereopod 5. While it is likely that *A. semidentatus* is present in Australian seas, until *bona fide* specimens are collected, it is best to regard existing records as doubtful.

*Aristeus mabahissae* Ramadan, 1938 (Fig. 4A)

*Aristeus mabahissae* Ramadan, 1938: 43, figs 2b, 3b, 4a-c; Crosnier, 1978: 65, figs 25e-f, 26e-f; 1984: 22; 1994a: 352, 1994b: 369; Hayashi 1983a: 190, figs 49, 50; Komai, 1993: 22.

MATERIAL. AMP39948, 33°40'S 152°E, 1115m, ♀, 38 mm; AMP39977, 33°S 151°E, 1097m, ♀, 42mm; AMP 55934, 34°53'S 151°E, 1116m, 4♀, 37-44mm; AMP 55938, 35°S 151°E, 1015m, ♂, 20mm, 2♀, 39, 40mm; NT Cr 007070, 29°S 114°E, 880m, 3♀, 39, 43, 53mm; NT Cr 007086, 13°S 122°E, 900m, 2♂, 28, 33mm, 2♀, 34, 41mm; CSIRO, SS/1/91 #44, 27°07'S 112°22'E, 714m, 2♀, 42, 46mm.

DIAGNOSIS. Carapace glabrous. Rostrum in ♀♀ and juvenile ♂♂ variable in length, usually well exceeding the antennular peduncle, the unarmed part slender and upturned, sometimes strongly; often shorter in adult ♂♂; in both sexes with 3 dorsal teeth, the first smaller than the

second and third; adrostral carina ending at the first rostral tooth; postrostral carina reaching about half the carapace. A low gastro-orbital carina above a short, shallow orbito-antennal sulcus; antennal spine extending back as a short antennal carina. A prominent branchiostegal spine on the border of the carapace, extending posteriorly as a sharp carina, which reaches the base of the cervical sulcus and thereafter continues as a blunt prominence, almost meeting the low branchiocardiac carina; hepatic sulcus starting below the cervical sulcus and joining the deep branchiocardiac sulcus, which almost reaches the posterior margin of the carapace. Cervical sulcus restricted to the lateral area of the carapace. A subdistal meral spine on pereopods 1 & 2; pereopod 5 with 4-10 photophores on the carpus and 8-13 on the propodus.

*Colour.* Variable, the body slightly whitish, with the branchial area, posterior part of the abdominal somites, the extremities of the rostrum and appendages generally rose to rose-orange.

**REMARKS.** *A. mabahissae* appears to be fairly common in Australian seas. It is easily confused with *A. semidentatus*, but this species may be distinguished by the number of photophores on pereopod 5 (carpus 13-33 and propodus 20-31).

**DISTRIBUTION.** Eastern Australia 28°-34°S, Western Australia 13°-29°S; 500-1100m. Known range: Madagascar, Maldive Islands, Indonesia, South China Sea, Japan, Australia, Wallis and Futuma Islands, 500-1100m.

***Aristeus virilis* (Bate, 1881)  
(Fig. 4B)**

*Hemipenaeus virilis* Bate, 1881: 187; 1888: 303, pl. 44, fig. 4.  
*Aristeus tomentosus* Bate, 1881: 189; 1888: 307, pl. 49, figs 2, 3, pl. 50.

*Aristaeus virilis* Faxon, 1895: 198; Alcock, 1901: 30; Kubo, 1949: 194, figs 1, 6, 8, 11, 13, 14, 19, 23, 36, 44, 65, 69, 72, 78, 85, 86.

*Aristeus virilis* Bouvier, 1908: 70; de Man, 1911: 6, 27; 1913: pl. 2, fig. 6; Ramadan, 1938: 39; Okada et al., 1966: 140, 141, 151, pl. 1, fig. 3; Crosnier, 1978: 61, figs 25a-b, 26a-b; 1984: 21; 1985: 861; 1989: 42; 1994a: 352; Hayashi 1983a: 190, figs 51, 52c,d; de Freitas: 3, fig. 11-1, 1985; Liu & Zhong, 1986: 37, fig. 14; Kensley et al., 1987: 281.

**MATERIAL.** AM P21683, 29°46'S 154°E, 500m, 3♂, 30, 38, 38mm, 4♀, 34-57mm; QMW11282, 23°S 154°E, 460m, ♂, 39mm, ♀, 55mm; QMW11429, 23°34'S 154°E, 650m, ♀, 48mm; QMW14296, 23°40'S 154°E, 530m, ♀, 38mm; QMW18059, due E Brisbane 28°S, 700-900m, 3♀, 43, 57, 57mm; QMW20793, 18°S 118°E, 250-390m, ♀, 53mm; NT Cr006630, 8°38'S 132°E, 2♀, 39, 40mm; CSIRO. SS/1/91 #43, 27°S 112°E, ♀, 53mm.

**DIAGNOSIS.** Body, pereopods and other appendages with a fine pubescence. Adrostral carina ending just behind the first rostral tooth; postrostral carina low but reaching three-quarters the length of the carapace. A low gastro-orbital carina above a short, but distinct orbito-antennal sulcus. Branchiostegal spine on the border of the carapace and continuous with a prominent carina, which almost reaches the branchiocardiac carina; hepatic sulcus beside the posterior half of the branchiostegal carina. Branchiocardiac sulcus deep and almost reaching the posterior border of the carapace. A sub-distal, ventrolateral movable spine on the merus of pereopods 1-3. Carpus of pereopod 5 with 15-25 photophores, propodus with 16-22.

*Colour.* Red-orange, deeper on the margin of the carapace and rostrum, the posterior edges of the abdominal somites, the uropods and telson; pereopods lighter in colour.

**REMARKS.** This appears to be the commonest of the Australian species of *Aristeus* and is readily identifiable by the key characters.

**DISTRIBUTION.** Eastern Australia 10°-34°S, Arafura Sea 8°S 132°E, through Northwest Shelf to 29°S; 250-1050m. Known range: South Africa, Madagascar, Andaman Islands, Indonesia, South China, Philippines, Japan, Australia, New Caledonia, New Hebrides, Wallis and Futuma Islands, 250-1050m.

***Austropenaeus* Pérez Farfante  
& Kensley, 1997**

*Austropenaeus* Pérez Farfante & Kensley, 1997: 4, figs 11, 12

**DIAGNOSIS.** Integument glabrous. Rostrum slender and upcurved, approx. 1.3-1.4 the length of the carapace in adult ♀♀, slightly shorter, but still exceeding the length of the carapace in adult ♂♂; with 3 dorsal teeth; adrostral carina short, starting at the base of the third tooth and ending behind the first tooth; postrostral carina reaching about one third of the carapace. Carapace with an antennal and a prominent branchiostegal spine on the margin of the carapace, with a short carina; hepatic sulcus wide and almost reaching the branchiocardiac sulcus; the latter barely defined, but almost reaching the posterior margin of the carapace; cervical sulcus short and indistinct; carapace otherwise almost featureless. Abdominal somite 3 without a distinct carina, but with a postero-dorsal spine; somites 4-6 each dorsally carinate and ending in a spine; telson acute with 4 pairs of lateral movable spines.



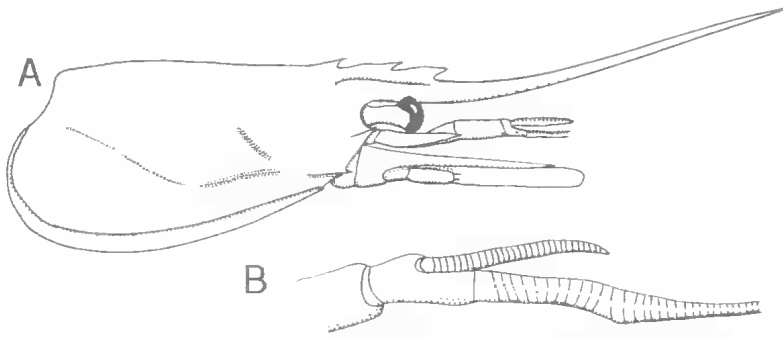


FIG. 5. A, *Austropenaeus nitidus* (Barnard, 1947) AMP55939, 33°51'S, 152°15'E, 1200m, ♀, 26mm. B, AMP55395, 34°53'S, 151°15'E, 1116m, ♂, 21mm, antennular flagella, lateral view.

Cornea slightly flattened, peduncle with a prominent mesial tubercle. Dorsal antennular flagellum flattened and reaching as far as the spine of the scaphocerite in females, slightly longer in males; ventral flagellum slender, terete and in the male with a proximal enlargement (Fig. 5B); scaphocerite not modified in the adult male, but with the dactyl of the third maxilliped thicker basally, with a finger-like distal part and shorter than in the female. Rudimentary exopods on all pereopods (Fig. 1), pereopods 1-3 slender and each with a sub-distal movable spine on the merus; the fourth and fifth more slender than the first to third. Dorsolateral lobule of petasma produced as a rounded process, well exceeding the ventromedian lobule; distal ventrolateral lobule semicircular and rounded; thelycum with apically pointed shield-shaped sternal plate on thoracic sternite 7, sternite 8 with low median prominence and paired anterolateral ridges.

REMARKS. This genus contains only *A. nitidus*, formerly included in *Plesiopenaeus*. The key characters enable *Austropenaeus* to be easily separated from *Plesiopenaeus*, notably by the almost featureless carapace. However, the rudimentary exopods on the pereopods, which separate it from other genera, are easily missed.

***Austropenaeus nitidus* (Barnard, 1947)**  
(Figs 1, 5A,B)

*Plesiopenaeus nitidus* Barnard, 1947: 383, 1950: 622; Crosnier, 1978: 89; Kikuchi & Nemoto, 1986: 52.

MATERIAL. AMP39951, 33°40'S 152°E, 1115m, ♀, 30mm; AMP 39979, 33°S 153°E, 1095m, 2♂, 21, 24mm, 5 ♀, 22-24mm; AM K24-20-03, E Sydney, 969-1006m, 5 ♀, 16-26mm; AMP55392, 38°S 150°21'E, 960m, ♀, 26mm; AMP 55395, 35°S 151°E, 1116m, 2♂, 21mm, 24mm, ♀, 26mm; AMP55396, 34°50'S 151°E, 1225m,

4 ♀, 25-33 mm; AMP55939, 33°51'S, 152°15'E, 1200m, ♀, 26mm; SAM (unregistered, Great Australian Bight approx. 34°S, 128 to 132°E, 927-1249m), 5 ♀, 30-37.5mm; CSIRO, SS/1/91 # 33, #47, #61, 29°35'S 111-113°E, 1101-1277m, ♂ 25 mm, 6 ♀, 25-31mm.

DIAGNOSIS. As for genus.

REMARKS. Kikuchi & Nemoto (1986) recorded 1 ♀ *A. nitidus* (as *Plesiopenaeus nitidus*) from the Northwest Pacific. It was collected around 22°N in a

0-5700m oblique tow, whereas all Southern Hemisphere *A. nitidus* have been collected in bottom trawls S of 26°S, nearly all between 1000-1300m. It is moderately common in the southern part of Australia, but to date it has not been found anywhere between 22°N and 26°S. Thus the identity of the Northwest Pacific species needs to be confirmed.

DISTRIBUTION. Australia S of 26°S, WA, through the Great Australian Bight and approaches to Bass Strait (approximately 40° S), to 27°S on the NSW coast, usual depth range 1000-1300m, where it appears to be moderately common (one recorded depth of 457m, may be an error). Known range: with the possible exception noted above *A. nitidus* appears to be an inhabitant of latitudes higher than 26° S: south Atlantic Ocean; off Cape of Good Hope and Natal, South Africa; Amsterdam and St. Paul Islands, south Indian Ocean; southern Australia, 457-1300m.

***Hemipenaeus* Bate, 1881**

*Hemipenaeus* Bate, 1881: 171, 186; 1888: 299; de Man, 1911: 23; Burkenroad, 1936: 90; Ramadan, 1938: 47; Anderson & Lindner, 1943: 300; Roberts & Pequegnat, 1970: 43; Crosnier, 1978: 74; Hayashi, 1983c: 366; Pérez Farfante & Kensley, 1997: 43.  
*Hemipeneus* Faxon, 1985: 198.  
*Aristeus* (*Hemipeneus*) Alcock, 1901: 31 [part].  
*Hemypenaeus* Kikuchi & Nemoto, 1986: 52.

DIAGNOSIS. Integument glabrous. Rostrum usually short in both sexes, occasionally of moderate length in ♀♀; with 3 dorsal teeth; a short adrostral carina present; postrostral carina pronounced, reaching at least to the midlength of the carapace. Antennal and branchiostegal spines present, the latter on the margin of the carapace and with a prominent carina; cervical and

postcervical sulci present or absent; branchiocardiac carina and sulcus well-defined. Abdominal somite 3 with a prominent downcurved spine; somites 4-6 each with a dorsal carina; telson with 4 pairs of small movable spines in the posterior half, apex acute. Cornea moderately small, dorsoventrally flattened; ventral antennular flagellum not modified in the male. All pereopods with rudimentary exopods (Fig. 1); no movable meral spines on the pereopods. Petasma with distal margin of the dorsolateral lobule oblique and about the same length as the dorsomedian lobule; distal half of ventral costa free, the tip flattened with laterally directed projection. Thelycum with broad, anteriorly pointed plate on thoracic somite 7, somite 8 short and broad, roughly rectangular.

**REMARKS.** The genus contains only *H. carpenteri* and *H. spinidorsalis*. Both are deep water inhabitants, usually below 2000 m, which probably explains their apparent rarity. *H. carpenteri* is easily distinguished by its cervical and postcervical sulci (although these may be quite faint dorsally), which are totally lacking in *H. spinidorsalis*. Only *H. carpenteri* has been collected in Australian waters, although both species have a similar range.

**Hemipenaeus carpenteri** Wood-Mason, 1891  
(Fig. 6)

*Hemipenaeus Carpenteri* Wood-Mason, 1891: 189; Wood-Mason & Alcock, 1891b: 286; de Man, 1911: 6, 23. *Hemipenaeus triton* Faxon, 1893: 215; 1895: 202, pl. 50, 1896: 163. *Aristeus (Hemipenaeus) carpenteri* Alcock & McArdle, 1901: pl. 49, fig. 4. *Aristeus (Hemipenaeus) Carpenteri* Alcock, 1901: 32. *Hemipenaeus carpenteri* Burkenroad, 1936: 91; Ramadan, 1938: 48; Anderson & Lindner, 1945: 301; Roberts & Pequegnat, 1970: 43; Pequegnat & Roberts, 1971: 8, pl. 5D; Crosnier, 1978: 76, figs 27 c-d, 28 a-b, 29a, 1985: 862, 1994b: 369; Hayashi 1983c: 366, fig. 57.

**MATERIAL.** QMW13261, 16°54'S 147°E, 1473-1590m, ♀, 8mm; QMW13451, 17°S 148°E, 1500m, ♀, 35mm; TMH G4044, 21°S 113°E, 1139-1128m, ♀, 20mm; G4045, 23°S 113°E, 1460-1700, 2♂, 24, 24mm.

**DIAGNOSIS.** Rostrum short in both sexes, not exceeding the tip of the cornea in adults, slightly longer in the 8mm juvenile, with 3 dorsal teeth; a short adrostral carina present, ending between the first

and second rostral teeth; postrostral carina prominent, ending at 0.7-0.8 the length of the carapace. Gastro-orbital carina present, almost reaching the cervical sulcus. Antennal and branchiostegal spines present, the latter on the margin of the carapace and with a prominent carina reaching below the lower extremity of the cervical sulcus. A shallow hepatic sulcus, continuous with the deep branchiocardiac sulcus, which almost reaches the posterior margin of the carapace. Lower half of the cervical sulcus well-defined, with a very short carina at its lower end; upper part faint, but reaching the mid-dorsum; a faint postcervical sulcus present; submarginal carina sharp. Abdominal somite 3 with a large down-curved postero-dorsal spine; a dorsal carina on each of abdominal somites 4-6, that on the fourth weak. Ventral costa of the petasma free distally, the apex markedly flattened, with a laterally directed point. Thelycal plate on thoracic somite 7 with a long tapering anterior point.

**Colour.** Carapace deep blue, abdomen lighter blue anteriorly, changing to pinkish towards the telson; appendages pink to red.

**REMARKS.** The 20mm ♀ (Fig.6) appeared to be close to sexual maturity, the thelycum being similar to that figured by Crosnier (1978, fig. 28a, b). The petasma of a mature ♂ does not appear to have been figured, but although one 24mm ♂ had well-developed petasmas halves they were not joined medially and it was therefore immature. Consequently, it has not been figured. The other ♂, although of identical size, was decidedly immature.

**DISTRIBUTION.** Western Australia, 20-22°S 113°E, 1100-1700m; NE Australia, 16-17°S 147°E; 1473-1590m. Known range: throughout the Indian Ocean, Indonesia, Japan, Australia, Wallis and Futuna Islands; Gulf of Panama and Galapagos Islands; W Atlantic, 900-3900m.

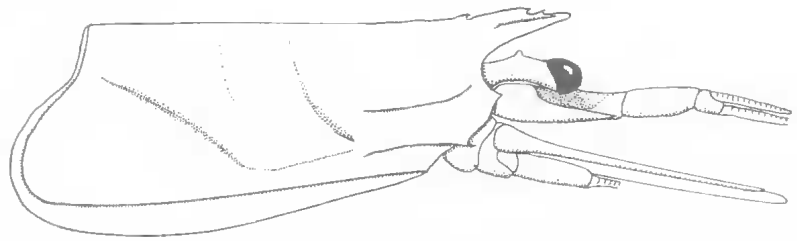


FIG. 6. *Hemipenaeus carpenteri* Wood Mason, 1891 TMHG4044, 20°55'S, 112°51'E, 1139m, ♀, 20mm.

**Hepomadus Bate, 1881**

*Hepomadus* Bate, 1881: 171, 189, 188: 319; Bouvier, 1908: 56; Milne Edwards & Bouvier, 1909: 194; Burkenroad, 1936: 86; Ramadan, 1938: 55; Pérez Farfante, 1973: 441; Crosnier, 1978: 47; Liu & Zhong, 1986: 28; Pérez Farfante & Kensley, 1997: 46.  
*Aristeus* (*Hepomadus*) Alcock, 1901: 42.

**DIAGNOSIS.** Cuticle glabrous. Rostrum exceeding the antennular peduncle, with 3 dorsal teeth, including the epigastric. Postrostral carina variable; adrostral carina present. Antennal spine present; branchiostegal spine on the margin of the carapace at the end of a sharp carina; hepatic spine present, hepatic sulcus well-defined below the spine; branchiocardiac sulcus deep, the sulcus prominent and accompanying the carina almost to the margin of the carapace; cervical sulcus well defined and reaching to at least the dorsal region of the carapace. Abdominal somite 3 with or without a prominent posterodorsal spine; somites 4-6 dorsally carinate; telson with 4 pairs of lateral movable spines. Eye small, cornea flattened; ventral flagellum of antennule not sexually dimorphic; scaphocerite exceeding the antennular peduncle, its apex well exceeding the distolateral tooth. Pereopods with rudimentary exopods, sometimes lacking on the fifth; a distal movable spine on the mcrus of pereopods 1 & 2.

Dorsomedian lobule of the petasma nearly as long as the dorsolateral lobule, which is rounded distally; ventral costa with distal half free, the tip tapering. Thelycum with large elongate median protuberance on thoracic somite 7, with pointed anterior tip reaching the anterior rim of sternite 6.

**REMARKS.** This genus includes *H. glacialis* Bate, 1881, South Atlantic; *H. inermis* Bate, 1881, south-central Pacific Ocean; *H. tener* Smith, 1884, Atlantic, Indian and Pacific Oceans. All 3 species inhabit deep water, which may explain their apparent rarity. *H. inermis* appears to have been collected only once (type locality, depth 4665 m) and *H. glacialis* is almost as rare

(depth ca. 3400 m). However, *H. tener*, with a depth range of 765-5400m, mean 2400m, has been collected on a number of occasions, although still considered rare.

**KEY TO THE SPECIES OF *HEPOMADUS***

1. A prominent posterodorsal spine on abdominal somite 3 . . . . . 2  
 No posterodorsal spine on abdominal somite 3 . . . . . *H. inermis*
2. Carapace with a pronounced hump behind the cervical sulcus, which interrupts the postrostral carina . . . . . *H. glacialis*  
 Carapace only slightly arched behind the cervical sulcus, postrostral carina continuing uninterrupted almost to the posterior margin of the carapace . . . . . *H. tener*

***Hepomadus tener* Smith, 1884**  
 (Fig. 7)

*Hepomadus tener* Smith, 1884: 409, pl. 9, fig. 7-8; 1887; Bouvier, 1908: 57, pl. 1, fig. 5, pl. 13, figs 1-12; Burkenroad, 1936: 86; Ramadan, 1938: 55; Roberts & Pequegnat, 1970: 43, fig. 3; Pequegnat & Roberts, 1971: 9; Pérez Farfante, 1973: 442, figs 1-8; Crosnier, 1985: 860, 1994b: 369; Liu & Zhong, 1986: 28, fig. 10.  
*Hepomadus tener?* Wood-Mason & Alcock, 1981: 189.  
*Aristaeus* (*Hepomadus*) *tener?* Alcock, 1901: 42.  
*Hepomadus glacialis* Milne Edwards & Bouvier, 1909: 194, figs 13-19, pl. 1 fig 3.

**MATERIAL.** TMH G4046, 22°S 113°E, 1460-1700m, 4♂, 21-34mm, 2♀, 29, 37mm.

**DIAGNOSIS.** Cuticle flexible and glabrous. Rostrum styliform, upturned, its length relative to that of the carapace increasing with size, being shorter in smaller specimens and longer in larger specimens; with 3 dorsal teeth including the epigastric; adrostral carina well defined, reaching at least the base of the epigastric tooth. Postrostral carina almost reaching the posterior margin of the carapace, the postrostral region of the carapace slightly convex. Antennal, hepatic and branchiostegal spines present, the latter on the margin of the carapace at the end of a prominent carina, which extends as far as the hepatic spine. An orbito-antennal sulcus present, continuous with a deep hepatic sulcus, which meets the branchiocardiac sulcus, before turning ventrad. Branchiocardiac sulcus deep, the carina prominent, both almost reaching the posterior margin of the carapace, before turning ventrad. Cervical sulcus well-defined and reaching the postrostral carina; postcervical sulcus faint.

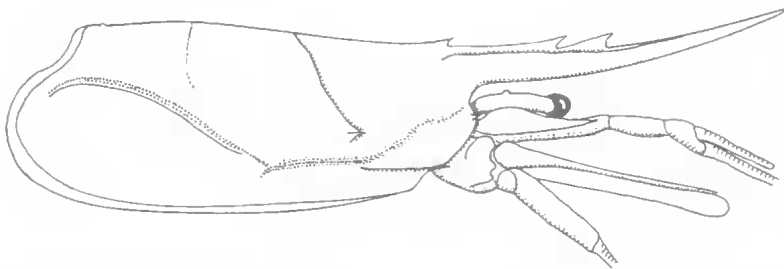


FIG. 7. *Hepomadus tener* Smith, 1884, TMH4046, 22°S, 113°8'E, 1460-1700m (aborted trawl), ♂, 31mm.

Abdominal somite 3 with weak dorsal carina on its posterior half ending in a large, down-curving spine; somites 4-6 each with a sharp dorsal carina; telson with 4 small movable spines. Optic peduncle long, cornea small and slightly flattened. Scaphocerite exceeding the antennular peduncle, the tip longer than the distolateral spine. Pereopods 1 & 2 each with a prominent movable meral spine. Dorsomedian lobules of petasma diverging distally; dorsolateral lobule rounded distally, about as long as the dorsomedian lobule; ventral costa prominent, the distal half free and ending in bluntly pointed tip, directed laterally. Thelycum with an elongate plate on thoracic sternite 7, the sides rounded and pointed apex reaching almost to sternite 5; sternite 8 subrectangular, more or less convex.

REMARKS. Pérez Farfante (1973) found a good deal of variation in specimens from the Atlantic, but nevertheless *H. tener* is a distinctive species.

DISTRIBUTION. NW Australia, 22°S 113°E; 1460-1700m. Known range: Zanzibar, Madagascar, Réunion, central Indian Ocean, Bay of Bengal, Australia, Wallis and Futuma Islands, W and E Atlantic Ocean, 765-5400m.

#### *Parahepomadus* Crosnier, 1978

*Parahepomadus* Crosnier, 1978: 47; Liu & Zhong, 1986: 30; Pérez Farfante & Kensley, 1997: 48.

TYPE SPECIES. *Parahepomadus vaubani* Crosnier, 1978 (monotypic).

DIAGNOSIS. Cuticle thin and flexible, finely pubescent. Rostrum often short in adults of both sexes, not reaching beyond the second segment of the antennular peduncle, but may be slender and well exceeding the peduncle. Adrostral carina reaching just past the first rostral tooth; postrostral carina reaching about half the carapace. Postorbital spine present, continuous with the gastro-orbital carina, which almost reaches the shallow cervical sulcus, the latter limited to the lateral region of the carapace. A very small antennal spine may be present, absent in the larger specimens, but with the low antennal carina ending in a minute

tubercle just behind the carapace margin; orbito-antennal sulcus deep, continuous with the hepatic and branchiocardiac sulci. A large branchiostegal spine on the margin of the carapace, the branchiostegal carina reaching the branchiocardiac carina; the latter almost reaching the posterior margin of the carapace. Eye dorsoventrally flattened, with a small median tubercle on the peduncle; lower antennular flagellum with a slight sigmoidal flexure in males. Scaphocerite very wide; exopods usually absent from pereopods; minute subdistal meral spines on pereopods 1 & 2. Petasma very wide with rounded median lobe; thelycum a large concave setose plate, with prominent anterior point, on thoracic somite 7. Uniformly orange.

#### *Parahepomadus vaubani* Crosnier, 1978

(Fig. 8A, B)

*Parahepomadus vaubani* Crosnier, 1978: 48, figs 20-22, 1989, 1994a; Liu & Zhong 1986: 30, fig. 11.

MATERIAL. NT Cr007084, 13°S 122°E, 900-1000m, ♂, 48mm, ♀, 67mm; NTCr007085, 13°06' 122°18'E, 900-1000m, ♂, 53, 54mm, 2♀, 57, 58mm.

DIAGNOSIS. As for genus.

REMARKS. Two specimens had rudimentary exopods on pereopods 1-5, which could confuse identification, but the postantennal spine sets this apart from other members of the family. The normal very long slender rostrum is apparently subject to breakage, since most adults have a shortened rostrum (Crosnier, 1978, fig. 20).

DISTRIBUTION. Off the Northwest Shelf of Australia, 13°S 122°E; 900-1000m. Known

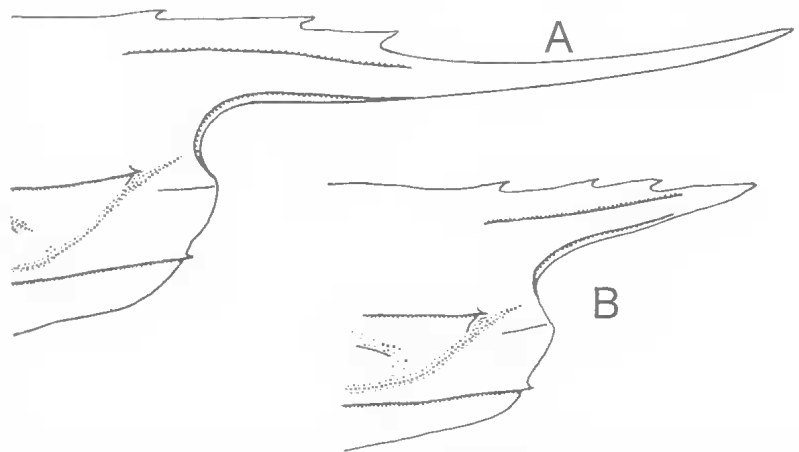


FIG. 8. *Parahepomadus vaubani* Crosnier, 1978 NT CR007085, 13°6'S 122°18'E, 900-1000m. A, ♀, 58 mm, rostrum. B, ♂, 54mm, short rostrum.

range: Madagascar, Indonesia, Australia, Philippines, 750-1525m.

### *Plesiopenaeus* Bate, 1881

*Aristeus* Bate, 1881: 187 [part]; 1888: 309 [part].

*Aristaeus* Wood-Mason 1891: 278 [part].

*Plesiopenaeus* Bate, 1881: 188; Bouvier, 1908: 63 [part]; Burkenroad, 1936: 94; Ramadan, 1938: 49 [part]; Barnard, 1950: 621; Crosnier, 1978: 85; de Freitas, 1985: 20; Pérez Farfante & Kensley, 1997:50.

*Plesiopenaeus* Faxon, 1895: 199.

*Aristeopsis* Bouvier, 1908: 61; Milne Edwards & Bouvier, 1909, 197.

**DIAGNOSIS.** Integument firm, glabrous. Rostrum longer than the carapace in juveniles and adult ♀♀, shorter in ♂♂; with 3 dorsal teeth. Antennal and branchiostegal spines prominent, the latter on the margin of the carapace and continuous with a sharp carina; orbital, postantennal, pterygostomial and hepatic spines absent; gastro-orbital carina present; cervical sulcus variable; branchiocardiac carina well-defined. Posterior half of abdominal somite 3 and 4-6 dorsally carinate. Telson with 4 pairs of movable lateral spines, apex acute. Cornea slightly flattened; a strong tubercle at about midlength of the peduncle. Dorsal antennular flagellum flattened, ventral flagellum elongate, slender and not modified in the adult ♂. Scaphocerite with thickened margin ending in a short spine at about 0.8 the length of the lamella. Merus of pereopod 1 or 1 & 2 with a sub-distal movable spine; exopods on all thoracic appendages, those of the pereopods rudimentary. Ventral costa of petasma free distally, the apical part hooked with tip directed laterally; thelycum with sternum of thoracic somite raised and shield-like, with acute apex.

**REMARKS.** This genus contains *P. armatus* and *P. coruscans*, *P. edwardsianus* and *P. nitidus* having been transferred to the monotypic genera *Aristaeopsis* and *Austropeneaus*, respectively (Pérez Farfante & Kensley, 1997). *P. armatus* is readily distinguished by a prominent dorsal spine

on abdominal somite 3, whereas *P. coruscans* has none.

### *Plesiopenaeus armatus* (Bate, 1881)

(Fig. 9)

*Aristeus armatus* Bate, 1881: 188, 1888: 312, pls. 45, 46.

*Aristeus ?tridens* Smith 1884: 104, pl. 9, 1886b: 189, 192, 193, 1887: 689, pl. 19.

*Aristaeopsis armata* Wood-Mason & Alcock, 1891b: 285.

*Plesiopenaeus armatus*, Faxon, 1895: 199, 1896: 163; Burkenroad, 1936: 95; Ramadan, 1938: 51, Anderson & Lindner, 1945: 301; Roberts & Pequegnat, 1970: 46; Pequegnat & Roberts, 1971: 8, pl. 5; Wasmer, 1972: 259; Crosnier & Forest, 1973: 294, fig. c-d; Crosnier, 1978: 93, fig. 33b, 1985: 863, 1994b: 369; Hayashi, 1983c: 368, fig. 58a-d; Pérez Farfante & Kensley, 1997: fig. 19.

*Aristaeus (Aristaeopsis) armatus* Alcock, 1901: 41.

*Aristeopsis armatus* Bouvier, 1905: 983; de Man, 1911: 6, Balss, 1925: 222.

*Aristeopsis armatus* var. *tridens* Bouvier, 1908: 62, pl. 11, fig. 6; Milne Edwards & Bouvier, 1909: 197, figs 4-7, 20-27; de Man, 1911: 6; Bouvier, 1922: 12.

*Plesiopenaeus armatus tridens* Burkenroad, 1936.

**MATERIAL.** AMP39932, 20°42'S 160°E, 2450m, ♂, 57mm, ♀, 56mm; AMP39939, 12°S 146°E, 2053m, ♀, 35mm; QMW13666 14°27'S 146°34'E, 1930-1942m, 4♀, 47-57mm; QMW136667, 13°40'S 147°43'E, 2884-2932m, ♂, 63mm, ♀, 54mm; QMW13668, 13°29'S 147°13'E, 2490-2542m, ♂, 60mm, 3♀, 55, 70 80mm; QMW13669 13°40'S 146°57'E, 1880-1921m, 3♂, 57, 61, 65mm, ♀, 43mm.

**DIAGNOSIS.** Carapace glabrous. Rostrum long, well exceeding the scaphocerite, with 3 dorsal teeth; adrostral carina ending in front of the first tooth; postrostral carina low and reaching about half the carapace. Antennal spine with a short carina; branchiostegal spine prominent, on the margin of the carapace and with a carina extending past the beginning of the branchiocardiac carina; the latter reaching the posterior margin of the carapace, both carina and sulcus well defined; orbito-antennal sulcus deep and continuous with the wide hepatic sulcus which becomes indistinct at the level of the branchiocardiac carina. A low gastro-orbital carina present; cervical carina and sulcus present in the lateral region of the carapace only, the latter very wide and shallow.

Abdominal somite 3 without a distinct dorsal carina, somites 4-6 each with a carina; somites 3-6 each ending in a large tooth, that of somite 6 smaller; pleura of somites 3-5 postero-ventrally mucronate. Eye small, flattened; stylocerite

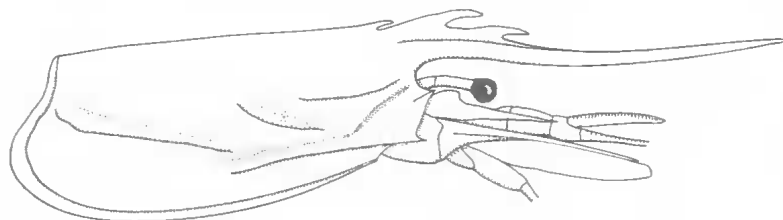


FIG. 9. *Plesiopenaeus armatus* (Bate, 1881) AMP39939, 11°42'S, 145°37'E, 2053m, ♀, 39mm.

exceeding the second antennular segment; scaphocerite not sexually dimorphic; exopods on pereopods rudimentary, without setae; a subdistal spine on the merus of pereopods 1 & 2. Thelycal plates on thoracic somite 5-8 with a prominent median ridge.

*Colour.* Uniformly wine red.

**REMARKS.** This is one of the largest aristeids, the 80 mm ♀ being in the upper size range. *Aristaeopsis edwardsiana* reaches a comparable size.

**DISTRIBUTION.** NE Australia 11-21°S, Lord Howe Rise 27-30°S 159°40'E; 1880-2930m. Cosmopolitan, W and E Atlantic, Indo-Pacific from Madagascar and Zanzibar, Bay of Bengal, Australia, Philippines, off Japan, off Hawaiian and Tuamotu Islands, W coast USA, 752-5413m.

***Plesiopenaeus coruscans***  
(Wood-Mason, 1891)

*Aristeus coruscans* Wood-Mason in Wood-Mason & Alcock, 1891b: 280, fig. 6.

*Aristaeus coruscans* Wood-Mason, 1892: pl. 2, fig. 3; Faxon, 1895: 198.

*Aristaeus (Plesiopenaeus) coruscans* Alcock, 1901: 37.

*Plesiopenaeus coruscans* Bouvier, 1908: 69; de Man, 1911: 6; Burkenroad, 1936: 95, fig. 61; Roberts & Pequegnal, 1971: 46; Crosnier, 1978:94, fig. 33c-f; Liu & Zhong 1986: 47, fig. 19.

**MATERIAL.** NTCR006994, 13°S 122°E, 900-1000m, ♀, 63mm.

**DIAGNOSIS.** Rostrum exceeding the antennular peduncle in juveniles and adult ♀♀, shorter in adult ♂♂; with 3 dorsal teeth; adrostral carina extending past first rostral tooth; postrostral carina nearly reaching the posterior margin of the carapace. Antennal spine with a carina almost reaching the orbito-antennal sulcus; gastro-orbital carina prominent and reaching the cervical sulcus; branchiostegal spine large and on the margin of the carapace, with prominent carina reaching the branchiocardiac carina. Hepatic sulcus continuous with the branchiocardiac sulcus, which, with the carina almost reaches the posterior margin of the carapace; cervical sulcus shallow, but almost reaching the mid-dorsum; a short carina on the lower part. A dorsal carina on the posterior half of abdominal somite 4 and on the full length of somite 5 & 6. Posteroventral pleura of abdominal somites 3-5 not mucronate. Eye dorsoventrally flattened, the peduncle long and with a prominent mesial tubercle. Pereopod 1 only with a sub-distal spine on the merus; rudimentary exopods on all pereopods. Thelycum with prominent anteriorly pointed flat

sternal plate on thoracic somite 7; somite 8 with a transverse low triangular projection.

*Colour.* Clear orange.

**REMARKS.** The sole specimen available was badly damaged and unsuitable for illustration (Crosnier, 1978). Its integument was exceptionally thin and flexible, more so than most other members of this family, and it could have been newly moulted. It is a large species and so far rare (Crosnier, 1978 noted that there were only 4 specimens known besides the 2 from Madagascar). Other features which distinguish it from *P. armatus* besides the absence of a large dorsal abdominal spine, are the cervical sulcus which almost reaches the mid-dorsum, lack of a spine on the merus of pereopod 2, lack of any armature on the pleura of the abdomen and a median carina on the thelycum.

**DISTRIBUTION.** Northwest Shelf of Australia, 900-1000m. Known range: Indian Ocean from Madagascar, the Arabian Sea, Bay of Bengal to NW Australia and the Atlantic Ocean, near the Bahamas, 900-2367m.

***Pseudaristeus* Crosnier, 1978**

*Hemipenaeus* Bate, 1881: 186 [part]; Ramadan, 1938: 47[part].

*Aristaeus* Wood-Mason, 1891: 278 [part].

*Aristaeus (Hemipenaeus)*, Alcock, 1901: 31 [part].

*Pseudaristeus* Crosnier, 1978: 81; de Freitas, 1985: 11; Pérez Farfante, 1987: 312; Pérez Farfante & Kensley, 1997: 52.

**DIAGNOSIS.** Integument pubescent. Rostrum elongate, when undamaged reaching well beyond the scaphocerite; with 3 dorsal teeth; postrostral carina defined. Carapace with antennal and marginal branchiostegal spines, the latter continuous with a strong carina; hepatic sulcus present; orbital, pterygostomial and hepatic spines absent; cervical sulcus reaching the mid-dorsum, a postcervical sulcus present; branchiocardiac carina and sulcus well defined. Abdominal somites 1-3 dorsally rounded, somites 4-6 dorsally carinate, somite 4 carinate in its posterior half only. Telson with slender acute apex, with 4 pairs of movable lateral spines. Eye well developed, dorsoventrally flattened; peduncle with a small tubercle on the mesial margin. Scaphocerite not sexually dimorphic. Pereopods without exopods, 1 & 2 each with a subdistal movable spine on the merus. Pereopod 3 without a podobranch. Petasma with distal margin of dorsolateral lobule oblique, reaching or slightly surpassing the median lobe; ventral costa distally free for ca. half its length, turning mesially. Thelycum open, with large lanceolate

plate on thoracic sternite 7; a broad plate on sternite 8, produced into anterolateral hoods.

The genus includes *P. crassipes* (Wood-Mason, 1891), *P. gracilis* (Bate, 1888), *P. kathleenae* Pérez Farfante, 1987, *P. protensus* Pérez Farfante, 1987, *P. sibogae* (De Man, 1911), and *P. speciosus* (Bate, 1881). The last is an Atlantic species and *P. gracilis* is known only from the Philippines. *P. sibogae* and *P. kathleenae* have both been collected from Australian seas, while *P. crassipes* has been found in Indonesia and could also be an Australian species. Pérez Farfante (1987) erected *P. protensus* on the differences in proportions of the thelycal plates, based on 2 ♀♀ from Indian seas, but Crosnier (1994a) considered it a doubtful species. More specimens, particularly a mature ♂ will be necessary to validate *P. protensus*.

KEY TO THE INDO-WEST PACIFIC SPECIES OF *PSEUDARISTEUS*

1. Pereopods covered with minute setae. Optic peduncle long, mesial margin at least 1.4 the width of the distal extremity . . . . . *P. sibogae*  
 Pereopods not covered with setae. Optic peduncle relatively short, mesial margin 1.3 or less the width of the distal extremity . . . . . 2
2. Third segment of antennular peduncle expanded laterally, forming a prominent subtriangular projection in males and a smaller rounded structure in females . . . . . *P. kathleenae*  
 Third segment of antennular peduncle not expanded laterally . . . . . 3
3. Males with ventral antennular flagellum sinuous proximally, with a narrow band of small dense setae, distal to the tip of the dorsal flagellum. Median thelycal plate of thoracic somite 7 expanded in a pair of posterolateral prominences . . . . . *P. gracilis*  
 Males with ventral antennular flagellum straight proximally and without a band of small setae. Median thelycal plate of thoracic somite 7 without posterolateral prominences . . . . . *P. crassipes*

***Pseudaristeus kathleenae* Pérez Farfante, 1987 (Fig. 10A,B)**

*Aristaeus crassipes* Wood-Mason, 1891 [part]; Alecock, 1901a [part].  
*Hemipenaeus crassipes* De Man, 1911: 24 [part]; 1913: pl. 2, fig. 4a-e; Kemp & Seymour Sewell, 1912: 17, pl. 1, fig. 8 [part]; Balss, 1925 [part].  
*Pseudaristeus kathleenae* Pérez Farfante, 1987: 314, figs 1-9; Crosnier, 1994a: 353; Pérez Farfante & Kensley, 1997: figs 21-23.

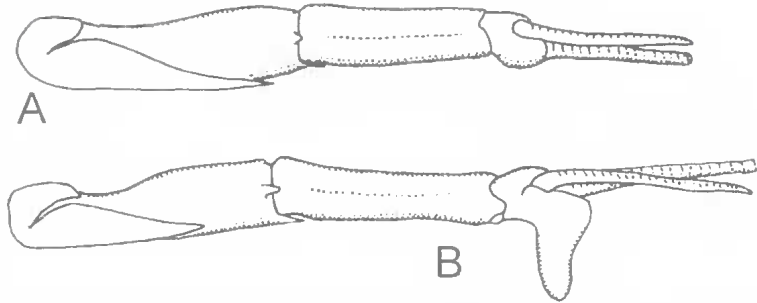


FIG. 10. *Pseudaristeus kathleenae* Pérez Farfante, 1987. A, NT CR 006629, 9°17'S 131°8'E, 297m, ♀, 36.5mm, antennule. B, ♂, 23.5mm, antennule (after Pérez Farfante, 1987, fig. 2).

MATERIAL. NT Cr006629, 9°17'S 131°E, 297m, 3 ♀, 29, 31, 36mm (all damaged and unsuitable for illustration).

**DIAGNOSIS.** Carapace finely pubescent, cuticle thin. Rostrum usually exceeding the antennular peduncle in ♀♀ and immature ♂♂, much shorter in mature ♂♂; with 3 dorsal teeth; adrostral carina ending just behind the first rostral tooth; postrostral carina distinct up to the cervical sulcus, becoming indistinct thereafter and reaching about 0.75 the carapace. Antennal spine prominent with the carina reaching the shallow orbito-antennal sulcus; gastro-orbital carina well defined and reaching the cervical sulcus. Branchiostegal spine large, on the margin of the carapace and continuous with a prominent carina, which almost reaches the branchiocardiac carina. Hepatic sulcus continuous with the orbito-antennal sulcus and turning sharply downwards at its junction with the branchiocardiac sulcus. Branchiocardiac carina forming a wide arc, which runs downward into the posterior margin of the carapace. Cervical sulcus shallow, but crossing the mid-dorsum, the carina limited to a short prominent shallow arc in its ventral region; postcervical sulcus not quite reaching the mid-dorsum and curving anteriorly towards the cervical sulcus, but not meeting it; with a low carina in its ventral region. Abdomen dorsally carinate on somites 4-6, each carina ending in a tooth. Mesial length of the optic peduncle/ maximum width at the cornea about 1.0. Tip of stylocerite well short of the disto-lateral spine of the first segment of the antennular peduncle; third segment with a large triangular ventro-lateral expansion ♂ and a rounded bulbous swelling in ♀ (Fig. 10A, B). Third maxilliped dimorphic, in the male the dactyl inserted subapically in the propodus, curved and of uniform width, with a dense tuft of

subapical setae. Pereopods 1 & 2 with subdistal spine on the merus. Dorsolateral lobule of petasma expanding distolaterally before tapering to a bluntly pointed mesial apex. Sternal plate of thoracic somite 7 a large densely setose lanceolate plate, maximum width about 0.65 the length, plate on somite 8 produced anteriolaterally into a pair of short hoods.

REMARKS. Although the genus has been revised (Pérez Farfante, 1987) *P. sibogae*, *P. kathleenae* and *P. crassipes* have similar ranges and may still be confused. *P. sibogae* is reasonably distinctive (see under *P. sibogae* for a discussion of these features), but the ♀♀ of *P. kathleenae* and *P. crassipes* are difficult to distinguish. The ♂ *P. kathleenae* is readily separated from *P. crassipes* by the sexually dimorphic antennule and third maxilliped and the expanded dorsolateral lobule of the petasma. In contrast, in the ♀ only the swollen third segment of the antennular peduncle of *P. kathleenae* clearly distinguishes it from *P. crassipes* and this feature is easily missed. The thelycal plate on thoracic somite 7 appears to be relatively broader in *P. kathleenae* (width/length 0.67-0.75 versus 0.43-0.55 in *P. crassipes*). Otherwise the thelyca are similar. Crosnier (1978) showed that pereopods 1 & 2 were stouter in *P. sibogae* than in *P. crassipes* and *P. gracilis* by comparing the ratios of length/width of the carpi. These ratios for pereopods 1 & 2 are 8.5-8.9 and 10.5 respectively in *P. kathleenae* and 8.6-9.3 and 10.1-12.9 in *P. crassipes*, and so these 2 species are indistinguishable by this means. Thus the relative broadness of the thelycal plate is the only feature to assist identification of ♀♀ when the presence or absence of the swelling of the third segment of the antennular peduncle is in doubt.

DISTRIBUTION. Australia, Arafura Sea 9°S 131°E, 297m. Known range: Southern India, Indonesia, Arafura Sea, Philippines, 297-1225m. (The Australian location is much shallower than the other records of depth, which start at 549m.)

***Pseudaristeus sibogae* (de Man, 1911)**  
(Fig. 11A-E)

*Hemipenaeus sibogae* de Man, 1911: 25, 1913, pl. 2, fig. 5, 5a-c; Ramadan, 1938: 48; Anderson & Lindner, 1945: 301.

*Pseudaristeus sibogae* Crosnier, 1978: 83, figs 27a, 30a-c, 1994a: 353; de Freitas, 1985: 12, fig. 11-5; Pérez Farfante, 1987: 332, fig. 18.

MATERIAL. AMP41894, 22°S 114°E, 1158m, ♀, 37mm; AMP55940, 20°S 113°E, 914m, ♂, 24mm, ♀, 36mm; CSIRO SS/1/91, #13, #22, #24, #49, 23-28°S 111-114°E, 854-1305m, 3♂, 31, 32, 33mm, 10♀, 31-43 mm; QM W24354, 33°58'S 131°22'E, 1000m, ♂, 33mm.

DIAGNOSIS. Body finely pubescent. Rostrum normally exceeding the antennular peduncle in both sexes; with 3 dorsal teeth; adrostral carina ending at the first rostral tooth; postrostral carina reaching about 0.9 the length of the carapace. Antennal spine with carina; gastro-orbital carina and orbito-antennal sulcus present. A prominent branchiostegal spine on the margin of the carapace, with sharp carina reaching the branchiocardiac carina; hepatic sulcus wide; branchiocardiac carina low, but well-defined, the carina and sulcus reaching the posterior margin of the carapace, where they turn down, the sulcus joining the submarginal sulcus. Cervical sulcus shallow, but crossing the mid-dorsum, the carina limited to a short prominent shallow arc in its ventral region; a postcervical sulcus present, not

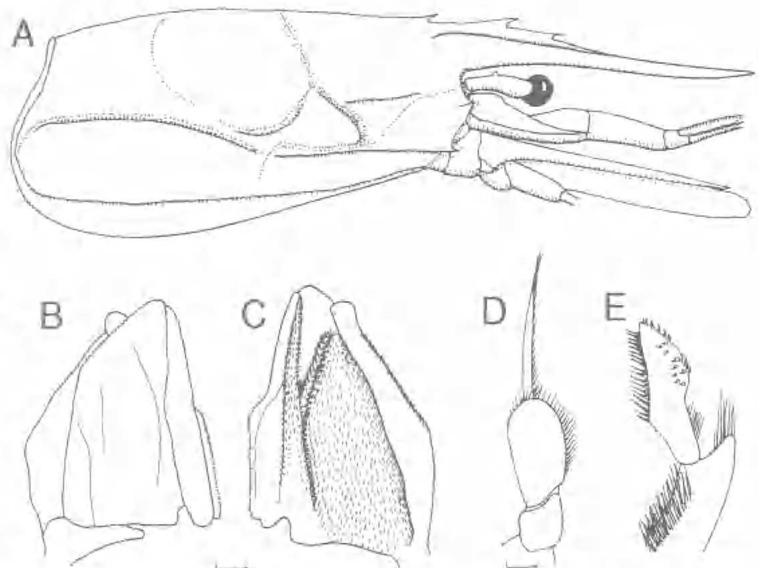


FIG. 11. A, *Pseudaristeus sibogae* (de Man, 1911) QMW25354, 33°58'S, 131°22'E, 1000m, ♂, 33mm; B, dorsal aspect of petasma; C, ventral aspect of petasma; D, appendix masculina; E, propodus and dactyl of maxilliped 3. (Scalebar = 1mm).



quite meeting the mid-dorsum; a short auxiliary posthepatic carina and sulcus running in an arc from the cervical sulcus towards the branchiocardiac sulcus. A dorsal carina beginning at the middle of abdominal somite 3, somites 3-6 each ending in a small tooth. Cornea flattened, the mesial length of the peduncle at least 1.4 times the maximum distal width at the cornea. Third maxilliped sexually dimorphic (Fig. 11 E); pereopods 1-3 relatively robust, 4 & 5 much more slender, all covered with a fine pubescence. Distal half of dorsomedian lobule of petasma free and reaching almost as far as the distolateral lobule (Fig. 11 B, C); the latter tapering towards the midline, apex rounded; ventral costa prominent, the distal half free, with truncated tip; ventral surface covered with fine setae. Appendix masculina with ovate outer plate; inner plate (appendix interna) about 2.5 times the length of the outer plate, flexible and tapering (Fig. 11 D). Thelycal plate on thoracic somite 8 produced anterolaterally into short hoods, that on somite 7 lanceolate, broad (width 0.6 length), without posterolateral prominences.

*Colour.* Orange.

REMARKS. *P. sibogae* has 4 distinctive features, which while reliable, are not completely definitive: the pubescent pereopods; the relatively long optic peduncle; the well-defined auxiliary carina and sulcus above the posterior hepatic sulcus; the stouter pereopods. The ratio of length/width of the optic peduncle was only 1.45 in these specimens, although Pérez Farfante (1987) recorded 1.5-1.75 (but such measurements are subject to operator variability). Other species also have at least indications of an auxiliary sulcus. Crosnier (1978) showed that the pereopods were stouter than in other species by comparing the ratios of length/width of podomeres of the pereopods, the ratios of the first and second in particular being appreciably smaller in *P. sibogae* than in other species. In the above specimens examined, the ratios of length/width of the carpus of pereopods 1 & 2 were 5.8-6.7 and 7.0-7.2, respectively,

which are close to those of Crosnier. Thus the only dubious feature in the specimens examined was the length/width ratio of the optic peduncle, but this appears to be a variable characteristic. Pérez Farfante (1987) used features of the genitalia to define species, but again ratios of length/breadth of thelycal plates appear to be variable.

The petasma of a mature ♂ (QM W24354, Fig. 11B, C), previously undescribed, is similar to that of *P. crassipes*, except for the fine setae on the ventral surface.

DISTRIBUTION. Western Australia 20-28°S, Great Australian Bight; 854 -1305m. Known range: Off Natal, South Africa, Madagascar, Indonesia, Australia, 834-1305m.

Family BENTHESICYMIDAE Wood-Mason, 1891

*Benthescymina* Wood-Mason, 1891: 286.  
*Benthescymae* Bouvier, 1908: 16; Burkenroad, 1936: 15; Anderson & Lindner, 1943: 290; Balss, 1957: 1517; Timizi, 1960: 321; Roberts & Pequegnat, 1970: 32.  
*Benthescyminae* Crosnier, 1978: 14; Hayashi, 1983d: 438.  
*Benthescyimidae* Pérez Farfante & Kensley, 1987: 56.

DIAGNOSIS. Integument thin and soft. Rostrum truncate and blade-like, with the tip usually falling short of the cornea, occasionally not reaching much beyond it; without adrostral carina; dorsally armed only with not more than 3, usually 2 or fewer dorsal teeth. Branchiostegite with a more or less deep antero-ventral emargination, with branchiostegal spine either on or just behind the carapace margin. Hepatic spine present or absent; hepatic carina and sulcus usually well defined; cervical and usually the postcervical sulcus reaching the dorsal mid-line. Telson with 1-4 pairs of movable lateral spines, apex usually acute, sometimes truncate. Eye medium to small, the peduncle with a mesial tubercle; prosartema usually only a tuft of setae; both antennular flagella long and filiform. Exopods on all maxillipeds, present or absent on pereopods. Petasma open, usually broadly lamellar, with the flexible part of the ventrolateral lobule attached to the dorsolateral lobule for most

TABLE 3. Distribution of branchiae and epipods on the thoracic somites of the genera of the Benthescyimidae.

Genus	Pleurobranchs Somites 3-8	Arthrobranchs Somite 1	2 Arthrobranchs Somites 2-7	Podobbranchs Somites 2-6	Epipods Somites 1-7
<i>Bentheogemmema</i>	+	1	+	+	+
<i>Benthescyminus</i>	+	s	+	+	+
<i>Benthonectes</i>	+	1	+	2 - 5, 6s	+
<i>Gemmadus</i>	+	r	+	somite 2 only	+

or all of its length; ventral costa entirely attached. Thelycum open or closed with seminal receptacles formed by paired sternal invaginations at the base of pereopods 3. Arrangement of branchiae and epipods in the genera of the Benthescymidae is shown in Table 3.

#### KEY TO THE GENERA OF THE BENTHESCYMIDAE

1. Podobranchs on thoracic somites 2-6; telson usually armed with more than one pair of lateral movable spines . . . 2  
 Podobranchs present on thoracic somite 2 only; telson armed with only one pair of lateral movable spines . . . . . *Gennadas*
2. Telson apically pointed. At least two abdominal somites dorsally carinate. . . . . 3  
 Telson apically truncate; only abdominal somite 6 dorsally carinate . . . . . *Bentheogennema*
3. Dactyls of pereopods 4 & 5 not multiarticulate and not markedly elongate; usually a dorsal carina on abdominal somite 4, as well as 5 & 6; dactyl of maxilliped 3 spinous and setose. . . . . *Benthescymus*  
 Dactyls of pereopods 4 & 5 multiarticulate and markedly elongate; a dorsal carina on abdominal somites 5 & 6 only; dactyl of maxilliped setose but not spinous . . . . . *Benthonectes*

*Gennadas* is well represented in Australian seas by 8 species, but so far only 2 *Benthescymus* species have been positively identified, with a possible third new species; *Bentheogennema* has yet to be recorded. NTCR007066 was identified as *Benthonectes filipes* by Dr A. Crosnier in 1990. However, I found that it is now too badly damaged to be positively identified, is of no value as a reference specimen, and a description of this species has therefore not been included (Pérez Farfante & Kensley, 1997 for description and figures).

#### *Benthescymus* Bate, 1881

*Benthescymus* Bate, 1881: 171, 190, 1888: 326; Alcock, 1901: 42; de Man, 1911: 13; Burkenroad, 1936: 23; Anderson & Lindner, 1943: 296; Tirmizi, 1960: 322; Crosnier, 1978: 15; Hayashi, 1983d: 438; Squires, 1990: 21; Kikuchi & Nemoto, 1991: 64; Pérez Farfante & Kensley, 1997: 59.

*Benthonectes* Smith, 1884: 391.

*Gennadas* Alcock, 1901: 46 [part].

**DIAGNOSIS.** Rostrum apically acute, often falling short of the cornea, with 0-3 dorsal teeth. Branchiostegal spine on or just behind the margin of the carapace, continuous with hepatic carina; hepatic spine present or absent; cervical, postcervical, hepatic and branchiocardiac sulci well marked. Abdominal somites 5 & 6 dorsally carinate, usually a low carina on the posterior half of the fourth. Telson with 4 pairs of movable lateral spines, apex acute. Eye medium to small,

the cornea slightly wider than the peduncle, brown to black-pigmented; a conical mesial process at about half the length of the peduncle. Dactyli of pereopods 4 & 5 slender and uniarticulate. Petasma with dorsolateral lobule broad, sometimes distally bilobed, longer than the ventrolateral lobule.

#### KEY TO THE INDO-WEST PACIFIC SPECIES OF *BENTHESCYMUS*

1. Branchiostegal spine at margin of carapace, branchiostegal carina not sharp; dactylus of 3rd maxilliped triangular, with only one strong spine at the tip (Group 1) . . . . . 2  
 Branchiostegal spine just behind margin of carapace, branchiostegal carina very sharp; dactylus of 3rd maxilliped subrectangular, distal margin with more than one strong spine (Group 2) . . . . . 11
2. Posterolateral margin of abdominal somite 4 crenate. . . 3  
 Posterolateral margin of abdominal somite 4 not crenate 4
3. Hepatic spine present; posterolateral margin of abdominal somite 5 without a spine; merus and ischium of maxilliped 3 each with a small acute spine on the median distal part. . . . . *B. crenatus*  
 Hepatic spine absent; posterolateral margin of abdominal somite 5 with a small spine; merus and ischium of maxilliped 3 each without spines on the median distal part . . . . . *B. laciniatus*
4. Hepatic spine present. . . . . 5  
 Hepatic spine absent . . . . . 10
5. Abdominal somite 3 with a postero-dorsal spine . . . . . *B. brasiliensis*  
 Abdominal somite 3 without a postero-dorsal spine . . . 6
6. Abdominal somite 4 with a postero-dorsal spine . . . . . \**B. urinator*  
 Abdominal somite 4 without a postero-dorsal spine . . . 7
7. Merus of 2nd maxilliped more than 3.5 times as long as broad. . . . . *B. strabus*  
 Merus of 2nd maxilliped less than 3 times as long as broad . . 8
8. Abdominal somites 5 & 6 each with a postero-dorsal spine . . . . . 9  
 Abdominal somites 5 & 6 each without a postero-dorsal spine . . . . . *B. iridescens*
9. Posterior rostral tooth usually anterior to the level of the orbital margin. . . . . *B. longipes*  
 Posterior rostral tooth well behind the level of the orbital margin . . . . . \**B. seymouri*
10. Abdominal somite 6 more than 2.5 times as long as the fifth somite . . . . . *B. brevirostris*  
 Abdominal somite 6 less than 2.5 times as long as the fifth somite . . . . . *B. carinatus*
11. Hepatic spine present . . . . . *B. tanneri*  
 Hepatic spine absent . . . . . 12
12. Abdominal somite 5 with a long spine extending backwards . . . . . 13  
 Abdominal somite 5 without a long postero-dorsal spine . . . . . 14
13. Long spine of abdominal somite 5 extending backwards from the middle of the dorsal mesial margin . . *B. bartletti*

- Long spine of abdominal somite 5 extending backwards from the postero-dorsal margin. . . . . *B. tirmiziae*  
 14. Postero-dorsal tip of abdominal somite 6 curving upwards . . . . . *B. alius*  
 Postero-dorsal tip of abdominal somite 6 directed horizontally . . . . . *B. investigatoris*

\*See discussion under *B. urinator howensis* sp. nov.

Only *B. investigatoris*, *B. urinator* and a possible new species have been collected from Australian seas, but probably more species are present as Kikuchi & Nemoto (1991) recorded 8 species from the NW Pacific and Crosnier (1978, 1985) 8 from the W Indian Ocean, 5 of which were common to those of Kikuchi & Nemoto (see Zoogeography of the Aristeidae and Benthescycymidae).

**Benthescycymus investigatoris** Alcock & Anderson, 1899 (Fig. 12)

*Benthescycymus investigatoris* Alcock & Anderson, 1899a: 282, 1899b: pl. 41, fig. 2; Alcock 1901: 44; Rathbun, 1906: 906; Balss, 1927: 247, fig. 1; Burkenroad, 1936: 49; Anderson & Lindner, 1945: 298; Crosnier, 1978: 21, pls. 7c-d, 8c-d, 9, 10, 1984: 20, 1985: 857, 1989: 41, 1994a: 351, 1994b: 368; Hayashi, 1983d: 440, fig. 61; Kensley et al., 1987: 276; Kikuchi & Nemoto, 1991: 88, figs 16, 17.

*Benthescycymus investigatori* Borradaile, 1910: 258.

*Benthescycymus Investigatoris* de Man, 1911: 5, 14; 1913: pl. 1, fig.1.

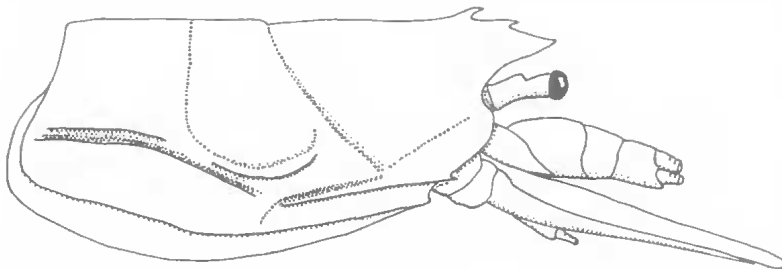


FIG. 12. *Benthescycymus investigatoris* Alcock & Anderson, 1899 AMP39937. 27°59' S, 162°48' E, 1250m, ♂, 16.5mm.

MATERIAL. AMP39937, 28°S 163°E, 1250m, 6♂, 15-16.5mm, 5♀, 12.5-15mm; QMW13483, 17°45' S 148°E, 1115m, 2♂, 14, 18mm, 6♀, 14-21mm; QMW13447, 17°19' S 147°47' E, 1100m, ♀, 20mm.

DIAGNOSIS. Rostrum reaching about half the cornea, with 2 teeth and a minute bump in the position of a third, more posterior tooth; postrostral carina ending at the cervical sulcus. Antennal and hepatic spines absent; orbito-antennal sulcus present; branchiostegal spine prominent, raised above the surface of the carapace, set back just behind its margin and continuous with a prominent hepatic carina, which extends as far as the branchiocardiac carina; both carina and sulcus well defined.

Cervical sulcus deep, with a shallow notch where it crosses the mid-dorsum. A posthepatic carina and sulcus present, the sulcus turning towards the dorsum, which it crosses without a notch, at about 0.6 the length of the carapace; the accompanying carina interrupted at this level, but continuing parallel to the branchiocardiac sulcus. A dorsal carina clearly defined on abdominal somites 5 & 6, a barely defined carina on the posterior of somite 4; that of somite 5 ending in a small spine. Eye small, with brown pigment; pereopod 1 with a subdistal movable spine on the merus; rudimentary exopods on all pereopods. Petasma with dorsolateral lobule distally entire and semicircular, with thickened rim, ventral costa prominent and reaching almost as far as the dorsolateral lobule. Thelycum with a triangular prominence on the sternum of thoracic somite 6, the sternum of thoracic somite 7 a rounded projection with anterior edge w-shaped, that of somite 8 with two lateral circular indentations.

REMARKS. Of the 20 specimens examined, 11 (of both sexes and little different in size) did not have a well-defined dorsal carina on abdominal somite 4, but were otherwise valid *B. investigatoris*. Thus this appears to be a variable character in this species.

DISTRIBUTION. E Australia 10-34°S; Lord Howe Rise 28°S 163°E; WA 29°05' S 113°14' E; Northwest Shelf 13°06' S 122°18' E; 879-1250m. Known range: throughout the Indo-West Pacific E coast of Africa, through the Indian Ocean, Indonesia, Australia, Philippines, Japan, Hawaii, Fiji, Wallis & Futuna Islands, 580-1690m. A common benthescycymid throughout its range; one trawl from the Cidaris' off NE Queensland included over 150.

**Benthescycymus urinator** Burkenroad, 1936

*Benthescycymus urinator* Burkenroad, 1936: 29, figs 4, 5, 8, 9, 17, 18, 22, 32, 33, 39, 40, 45. Crosnier, 1985: 843, fig. 2; Kikuchi & Nemoto, 1991: 67, figs 4, 5.

*Benthescycymus brasiliensis* Bate, 1881: 191, 1888: 332 [part].

*Benthescycymus moratus* Rathbun, 1906: 907.

DIAGNOSIS. Rostrum reaching about as far as the eye, tapering to the tip, with 2 fairly prominent dorsal teeth, with indications of a third; posterior tooth behind the margin of the

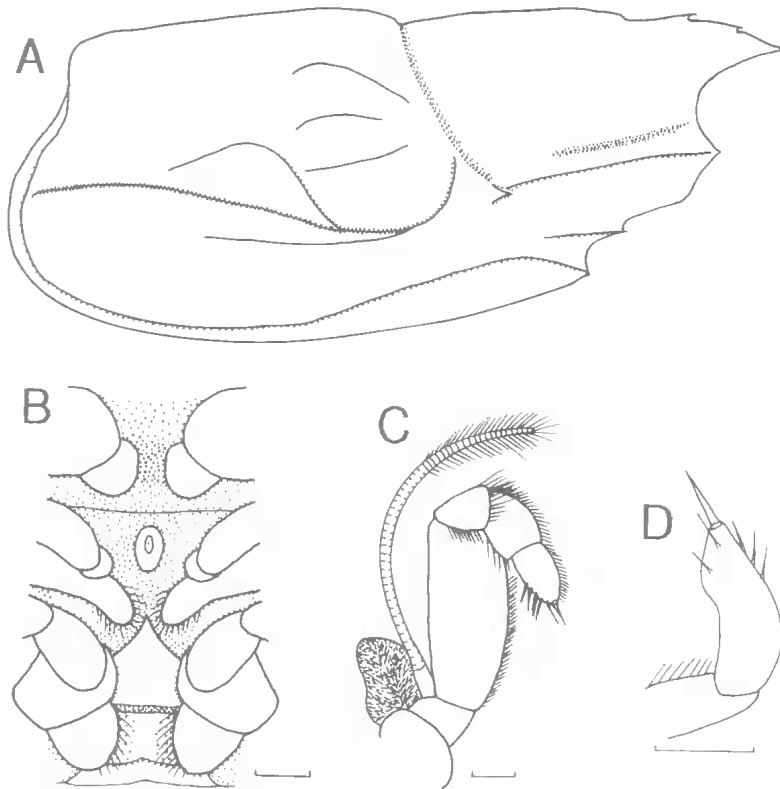


FIG. 13. *Benthescicymus urinator howensis* sp. nov. AM P40648, Lord Howe rise 28°44'S, 161°54'E, 1325m, ♀, 22mm. A, carapace; B, thelycum; C, maxilliped 2; D, maxilliped 3 dactyl. (Scalebar = 1mm)

carapace. Antennal spine acute, hepatic spine well developed; branchiostegal spine prominent, situated on the margin of the carapace and with a short carina. Cervical sulcus deep, notching the mid-dorsum and with a lower posterior branch which joins the branchiocardiac sulcus, the anterior branch reaching as far as the hepatic spine; branchiocardiac carina prominent; postcervical sulcus obscure; marginal carina well developed. Abdominal somites 4-6 carinate, each ending in a small spine; sixth somite more than twice as long as the fifth. Mandibular palp 2-segmented, basal segment 1.5 times the length and much broader than the distal segment, cutting edge of mandible straight with a small anterior tooth; endopod of second maxilla with long apical spine and seven long curved spines on the outer edge of the tip and a row of smaller spines on the inner edge; merus of second maxilliped expanded, length/width ratio 2.5, dactyl with 6 strong marginal spines; dactyl of third maxilliped broadest at its midpoint, tapering distally with 1 large spine at the tip.

Thelycum with inflated sternal plate on thoracic somite 8, a strong groove between sternites 7 & 8, sternite 7 with a prominent triangular projection, the apex directed anteriorly, a conical projection on somite 6.

REMARKS. Two ♂♂ and 2 ♀♀ (holotype and paratypes) were collected by the HMS Challenger' (Station 184) in the eastern approaches to Torres Strait. Kikuchi & Nemoto (1991) note that only 13 specimens have been collected in the Indo-West Pacific, so it appears to be uncommon, although widely distributed. All specimens are lodged in overseas museums and thus were not available (see, however, Fig. 13, *B. urinator howensis* sp. nov.). As it is a Group 1' benthescicymid it may be easily separated from the relatively common *B. investigatoris*.

DISTRIBUTION. Australia, Torres Strait approaches, 2560m. Known range: Indian Ocean, SW and N Pacific Oceans, 2500-4200m.

***Benthescicymus urinator howensis* sp. nov.**  
(Fig. 13A-D)

MATERIAL. AM P40648, Lord Howe Rise, 28°44'S 161°54'E, 1325m, 2♀, 22, 24mm.

DISCUSSION. The above description for *B. urinator* (see also Crosnier, 1985, Fig. 2a, Kikuchi & Nemoto, 1991, figs 4, 5a) fits these specimens exactly in all respects except for the armature of the abdomen. They lack a posterior-median spine of abdominal somite 4, which is a diagnostic feature of *B. urinator*, Crosnier (1985) remarking that this spine is the largest of the 3 abdominal spines. Unfortunately, the larger specimen is in poor condition and appears to lack a spine even on the fifth somite, but the 22mm specimen has a minute, but definite spine in this position, as well as a prominent spine on the sixth somite (both have a carina on the fifth

and sixth somites, but only a feeble indication of a carina on the fourth). As such it keys out as *B. seymouri*, which is obviously incorrect. Since the armature and carination of the abdominal somites are regarded as sufficiently stable to be used as key characters at both the specific and generic levels, these specimens may warrant the status of a new species. However, *B. urinator* is a rare species and the abdominal armature may be more variable than has been supposed. This plus the limited amount of material (only one relatively undamaged specimen) indicates that the erection of a new species would be unwarranted at this stage. Rather than designate it *Benthesicymus* sp. or *Benthesicymus* cf. *urinator*, in view of its close similarity to *B. urinator*, I prefer to assign it provisionally to a new subspecies.

**Gennadas Bate, 1881**

*Gennadas* Bate, 1881: 171, 191; 1888: 339; Alcock, 1901: 45; de Man, 1911: 15; Kemp, 1913: 60; Calman, 1925: 3; Balss, 1927: 248; Burkenroad, 1936: 59; Anderson & Lindner, 1943: 291; Barnard, 1950: 627; Kensley, 1971: 272; Crosnier, 1978: 33; Hayashi, 1984a: 18; Squires, 1990: 26; Pérez Farfante & Kensley, 1997: 63.

*Amalopenaeus* Smith, 1882: 86.  
*Pasiphodes* Filhol, 1885: pl 3.

**DIAGNOSIS.** Rostrum short, with a single dorsal tooth, not reaching as far as the cornea of the eye; adrostral carina absent, postrostral carina usually present. Antennal angle acute, narrowly rounded; infra-antennal angle demarcating a deep emargination of the carapace. A branchiostegal spine usually present on the inner edge of this emargination, branchiostegal carina present. Cervical and postcervical sulci present, both reaching the dorsal midline; a weak hepatic carina present. Only abdominal somite 6 with a dorsal carina; telson apically truncate, with a single pair of movable lateral spines. Second and third segments of antennular peduncle slightly expanded; exopod of first maxilliped without distal segmentation. Dactyli of pereopods 4 & 5 slender, unarticulate. Petasma with distal margin divided into external, median and internal lobes; accessory lobe always present; thelycum variable, but with small shallow seminal receptacles at the base of pereopod 3, with either paired openings or a common median opening.

**REMARKS.** Seventeen species of *Gennadas* world wide have been described of which 5 appear to be restricted to the Atlantic and 1 to the E Pacific, but most of the remainder have been recorded world wide. The following are Indo-West Pacific species: *G. bouvieri*, *capensis*, *crassus*, *gilchristi*, *incertus*, *kempii*, *parvus*,

*propinquus*, *scutatus*, *sordidus*, *tinayrei*. *G. parvus* Bate, 1881 has not yet been recorded from Australia, but in view of its wide distribution probably occurs here. *G. crassus* Tirmizi, 1960 has been recorded only from Zanzibar; *G. sordidus* Kemp, 1910 appears to be restricted to the NW Indian Ocean: the Arabian Sea, Gulf of Aden and Gulf of Oman. Neither of these species is included in the key below.

*Gennadas* species are soft and mostly < 10 mm CL; the features of the carapace and abdomen are closely similar and they would be extremely difficult to identify were it not for their very distinctive genitalia. The following keys use only features of the latter, with separate keys for males and females.

**KEY TO THE INDO-WEST PACIFIC SPECIES OF GENNADAS**

- Adult male petasmas:
1. Median lobe undivided . . . . . 2  
Median lobe divided . . . . . 4
  2. External lobe divided by closely approximate blunt lobules . . . . . *G. tinayrei*  
External lobe undivided or with a small acute medial process . . . . . 3
  3. Accessory lobe hipartite. . . . . *G. capensis*  
Accessory lobe a single flap . . . . . *G. kempii*
  4. Lobules of external lobe elongate, subequal, slender . . . . . *G. incertus*  
Lobules of external lobe not elongate, subequal, slender 5
  5. Lobules of median lobe hooked . . . . . *G. bouvieri*  
Lobules of median lobe not hooked . . . . . 6
  6. Accessory lobe a mere ridge. . . . . *G. parvus*  
Accessory lobe well developed. . . . . 7
  7. Apex of internal lobe acute . . . . . *G. gilchristi*  
Apex of internal lobe rounded . . . . . 8
  8. Inner lobule of median lobe apically acute. *G. propinquus*  
Inner lobule of median lobe apically truncate. *G. scutatus*
- Adult female thelyca:
1. A posteriorly directed tongue-like projection on thoracic sternite 5 . . . . . *G. tinayrei*  
No tongue-like posterior projection on thoracic sternite 5 . . . . . 2
  2. No obvious thelycal plate on thoracic somite 8 . . . . . *G. capensis*  
A well-developed thelycal plate on somite 8 . . . . . 3
  3. Thelycal plate on thoracic somite 8 with broad rounded anterior extension reaching sternite of somite 6 . . . . . *G. scutatus*  
Thelycal plate on thoracic somite 8 not reaching the sternite of somite 6 . . . . . 4
  4. Thelycal plate on thoracic somite 8 broad, anteriorly notched or indented and overlapping part of somite plate 7 . . . . . *G. incertus*  
Thelycal plate on thoracic somite 8 not indented anteriorly and not overlapping plate 7 . . . . . 5

5. Thelycal plate on thoracic somite 8 with two slender antero-lateral projections . . . . . *G. bouvieri*  
Thelycal plate on thoracic somite 8 without two slender antero-lateral projections . . . . . 6
6. Thelycal plate on thoracic somite 7 with two medial anterior projections . . . . . *G. gilchristi*  
Thelycal plate on thoracic somite 7 without two anterior projections . . . . . 7
7. A leaf-like process arising between the coxae of pereopods 3 & 4 and medially directed . . . . *G. parvus*  
No leaf-like process arising between the coxae of pereopods 3 & 4 . . . . . 8
8. Thelycal plate on thoracic somite 7 W-shaped . . . . *G. propinquus* . . . . .  
Thelycal plate on thoracic somite 7 rectangular. *G. kempi*

**Gennadas bouvieri** Kemp, 1909  
(Fig. 14A-C)

*Gennadas bouvieri* Kemp, 1909: 726, pl. 74, fig. 1-4, pl 75, fig. 6-7, 1910: 179; Burkenroad, 1936: 80; Anderson & Lindner, 1945: 293; Tirmizi, 1960: 360, figs 40d, 48e, 70-75; Kensley, 1968: 302, 1971: 273, fig. 1, 1972: 12, figs 4c, 6a; Roberts & Pequegnat, 1970: 36, figs 3-2B, 3-3C; Aizawa, 1974: 22, fig. 14; Crosnier, 1978: 34, figs 15a, 18a-b, 1994a: 352; Griffiths & Brandt, 1983: 179; Hayashi, 1984b: 140, fig. 66a-b; Kensley et al., 1987: 276.  
*Gennadas parvus* Bate, 1881: 192 [part], 1888: 340 [part], pl. 59; Wood-Mason & Alcock, 1891a: 189 [part], 1891b: 286 [part]; Alcock, 1901: 46 [part].  
*Gennadas elegans* Lenz & Strunck, 1914: 310 [part].  
*Amalopenaeus Alcocki* Balss, 1927: 266, fig. 30.  
*Amalopenaeus Bouvieri* Balss, 1927: 267.

MATERIAL. AM P32892, 33°28'S 152°34'E, 641m, ♂, 8.5 mm, 7♀, 6.5-8.8mm (4♀, 6.5-7.2mm immature); AMP32895, 33°20'S 152°32'E, 366m, 2♂, 8.0mm, ♀, 8.2mm.

DESCRIPTION. Antennal angle and infra-antennal angles acute, but blunt. Petasma with external lobe divided into 2 broad, bluntly pointed lobules; median lobe broad with wide distal notch, the 2 lobules acute and inwardly

hooked; inner lobe much shorter than the median lobules, with numerous cincinnuli; accessory lobe large, leaf-shaped. Thelycal plate on thoracic somite 8 with slender processes on its anterolateral corners; the shield-shaped plate on somite 7 attached anteriorly to the plate of the somite 6, with rounded flap opening posteriorly and a small process on either side.

Colour. Uniformly red.

REMARKS. The hooked lobules of the median petasmal lobe and the slender projections of the ♀ 8th thoracic sternite readily distinguish this species. Griffiths & Brandt (1983) recorded *G. bouvieri* at the edge or outside a warm-core eddy, where it appeared to be mesopelagic, but it was uncommon.

DISTRIBUTION. E Australia 17-39°S, 250-1988m. Known range: Indian Ocean; Indonesia; Arafura Sea; E Australia; Philippines; Japan; northwest Pacific; New Caledonia; Wallis and Futuna Islands, Eastern Pacific, Atlantic Ocean, 0-1115m, mostly 500-650m.

**Gennadas capensis** Calman, 1925  
(Fig. 15A-C)

*Gennadas capensis* Calman, 1925: 5, pl. 1, figs 1-2; Burkenroad, 1936: 67, figs 51, 53; Anderson & Lindner, 1945: 292; Barnard, 1950: 630, figs 118e-f; Roberts & Pequegnat, 1970: 34, fig. 3-2A; Kensley, 1971: 277, fig. 3; Abbes & Casanova, 1973: 268, fig. 5; Crosnier, 1978: 36, fig. 18c, 1985: 860, 1994b; Hayashi, 1984b: 141, fig. 66c-d; Kensley et al., 1971: 277, fig. 3, 1987: 277.

MATERIAL. AM P32880, 33°19'S 152°25'E, 640m, 5♂, 9.0-10.5mm, 7♀, 8.0-9.5mm; AMP32882, 33°28'S 152°34'E, 641m, 5♂, 10.2-13.2mm, 3♀, 9.1-12.0mm.

DIAGNOSIS. Antennal and infra-antennal angles acute. Lobes of the petasma not divided

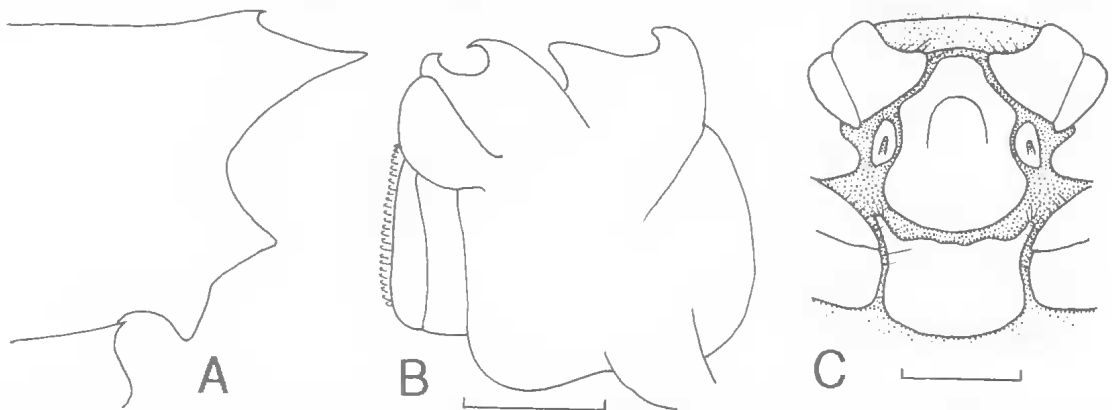


FIG. 14. *Gennadas bouvieri* Kemp, 1909 AMP32895, 33°20'S 152°32'E, 366m. A, ♂, 8 mm, anterior carapace; B, dorsal right half of petasma; C, ♀, 8.5 mm, thelycum. (Scalebar = 1 mm).

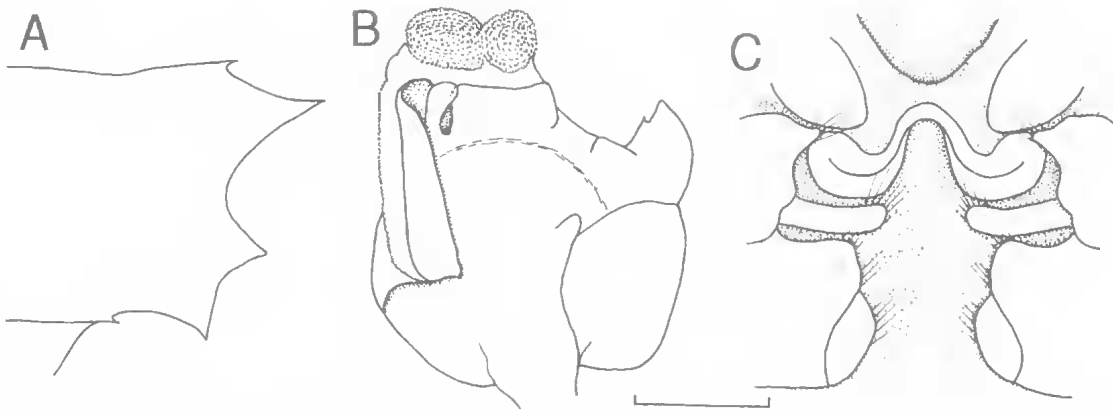


FIG. 15. *Gennadas capensis* Calman, 1925 AM P32880, 33°19'S 152°25'E, 640m. A, ♂, 10.5mm, anterior carapace; B, dorsal right half of petasma; C, ♀, 12mm, thelycum. (Scalebar = 1mm).

distally, but the external lobe with a small acute process on the medial margin; median lobe truncate and shorter than the adjacent lobes; inner lobe indented distally and covered with cincinnuli; accessory lobe divided, the inner lobule club-shaped, the outer truncate. Thelycal plate of thoracic somite 7 a prominent W-shape, median apex a rounded concave process; coxa of the pereopod 5 expanded and bilobed; coxa of the fourth with a slender elongate process; coxa of the third bluntly lobed; pereopod 3 with a pair of concave spoon-shaped processes posteriorly directed, meeting on midline.

*Colour.* Uniformly red.

**REMARKS.** This is one of the larger *Gennadas* (up to CL 13.2mm). A ♂ 7.5 mm CL was immature. *G. capensis* does not appear to be very common in Australian seas.

**DISTRIBUTION.** E Australia 22-39°S, 0-1988m, probably mesopelagic. Known range: W Indian Ocean; SE Australia; New Caledonia, Wallis and Futuna Islands, E Pacific, Atlantic Ocean, 0-2000m.

***Gennadas gilchristi* Calman, 1925**  
(Fig.16 A-C)

*Gennadas gilchristi* Calman, 1925: 6, pl. 1, figs 3, 4; Burkenroad, 1936: 66, fig. 58; Barnard, 1950: 633, fig. 118g,h; Kensley, 1968: 301, 1971: 280, fig. 6; Griffith & Brandt, 1983: 179; Iwasaki & Nemoto, 1987: 5; Kensley et al., 1987: 277.

**MATERIAL.** AMP52815, 34°S 152°E, 950m, 14♂, 4.5-7.3 mm, 6♀, 5-7.3mm

**DIAGNOSIS.** Antennal and infra-antennal angles produced, apically rounded. Petasma with external lobe acute and a smaller lobule at its

outer base; median lobe with 2 diverging slender lobules; internal lobe acute; accessory lobe broadly rounded (Fig. 16B). Thelycum with a pair of anterior projections on thoracic 7 thelycal plate; a visible pair of circular seminal receptacles usually containing spermatophores just anterior to it; thoracic 8 thelycal plate apple-shaped, anterior margin extending over thoracic plate 7. Coxa of pereopod 3 expanded, bilobed, more prominent in ♀. (Fig.16C)

*Colour.* Uniformly red.

**REMARKS.** The distinctive dark circular spermatophores, red in preserved material, make ♀ *G. gilchristi* readily identifiable; the petasma is also distinctive. Kensley et al. (1987) noted that this is the commonest species in NSW collections that they examined. Collections in the Museum of Victoria, made with mid-water trawls off SE Australia confirm this. In some cases they seemed to be associated with trawls consisting largely of salps, being the only decapod crustaceans present. Griffiths & Brandt (1983) recorded *G. gilchristi* as the most abundant *Gennadas* species associated with the Tasman Sea warm-core eddies that they investigated. *G. gilchristi* was mostly on or outside the edge of the eddy at around 250m depth and thus appears to be mesopelagic. Griffiths observed (F. B. Griffiths, pers. com.) that the gut contents were commonly green algae, and suggested that the *Gennadas* had been feeding on salp faeces.

**DISTRIBUTION.** SE Australia, 33°-42°S, 200-1200m, S of Australia, to 45°S 115°-150°E, 0-1050m. Known range: off Cape Peninsula and W coast of S. Africa, Argulhas Basin, S Indian Ocean, SE Australia, New Caledonia, 0-3400m.

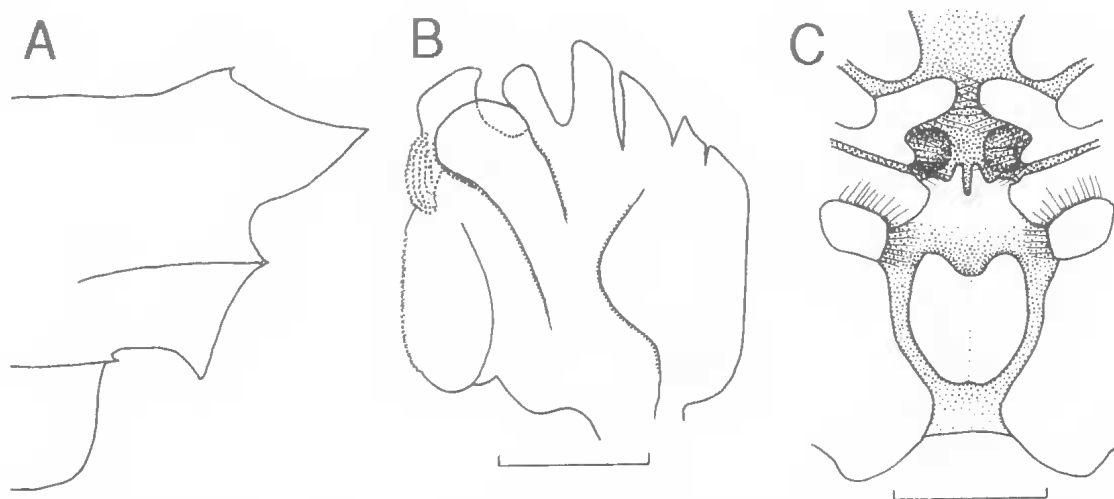


FIG. 16. *Gennadas gilchristi* Calman, 1925 AM P52815, 34°5'S 151°55'E, 950m. A, ♂, 7.3mm, anterior carapace; B, dorsal right half of petasma; C, ♀, 6mm, thelycum. (Scalebar = 1mm).

A mesopelagic species, preferred depth range appears to be 200-700m, mostly S of 30°S.

***Gennadas incertus* (Balss, 1927)**  
(Fig.17A-C)

*Amalopenacus incertus* Balss, 1927: 265, figs 24-29.

*Gennadas incertus* Burkenroad, 1936: 66; Anderson & Lindner, 1945: 294; Tirmizi, 1960: 364, fig. 40e, 48f, 76-80; Pearcey & Forss, 1966: 1137; Kensley, 1971: 284, fig. 7, 1972: 12, 14, fig. 4i, 5j; Aizawa, 1974: 23, 44, figs 15, 29; Crosnier, 1978: 37, fig. 15b; Griffiths & Brandt, 1983: 179; Hayashi, 1984b: 141, fig. 66e; Kensley et al., 1987: 278.

MATERIAL. AM P35740, 33°20'S 152°32'E, 550m, 2♂, 7.2, 7.7mm, ♀, 8.0mm; AMP35741, 33°19'S 152°25'E, 640m, ♂, 7.4mm

**DIAGNOSIS.** Antennal angle blunt, infra-antennal angle quadrangular. External lobe of the petasma divided into two long tapering lobules, projecting well beyond the other lobes; median lobe divided into 2 rounded lobules, the outer relatively narrow, the inner lobule broad; inner lobe not divided, with cincinnuli along its inner margin; accessory lobe simple and reaching as far as the inner and median lobes. Thelycal plate on thoracic somite 8 indented anteriorly, and overlapping sternite 7 anteriorly; sternite 7 thelycal plate with acute anterolateral corners, posterolateral corners with rounded processes extended anteriorly; somite 6 with large concave plate.

**Colour.** Body generally red, paling anteriorly and posteriorly; thoracic appendages 2-5 dark red

with purplish spots; pleopods pale red with dark purple spots.

**REMARKS.** Kensley (1971) described and a small posterior notch on the sternite of thoracic somite 8, which he used in his key to distinguish *G. incertus*. Liu & Zhong (1986, pl. 24, fig. 5) also showed a small indentation, but no trace of a notch could be found on ♀♀ from SE Australia. Crosnier (1978, fig.15b) did not show any posterior indentation. It therefore does not appear to be a reliable distinguishing feature. Griffiths & Brandt (1983) record this species associated with the edge of a warm-core eddy in the Tasman Sea, probably mesopelagic, but it was not common.

**DISTRIBUTION.** E Australia, 17-34°S, 220-1406m. Known range: Indian Ocean, Australia, New Caledonia, Japan, NW & E Pacific, SE Atlantic, 100-1406m (diurnal vertical migration).

***Gennadas kempfi* Stebbing, 1914**  
(Fig.18A-C)

*Gennadas kempfi* Stebbing, 1914: 283, pl. 27; Calman, 1925: 4; Burkenroad, 1936: 68, figs 52, 54; Barnard, 1950: 630, figs 118a-d; Kensley, 1971: 285, fig. 8; Iwasaki & Nemoto, 1987: 6; Kensley et al., 1987: 278.

MATERIAL. AMP32914, 33°31'S 152°20'E, 550m, ♂, 9.1mm; P32915, 33°19'S 152°25'E, 640m, 2♀, 9.2, 10.1mm.

**DIAGNOSIS.** Antennal and infra-antennal angles rounded. Petasma with external, median and internal lobes undivided; external lobe acute; median lobe broad and truncate; internal lobe



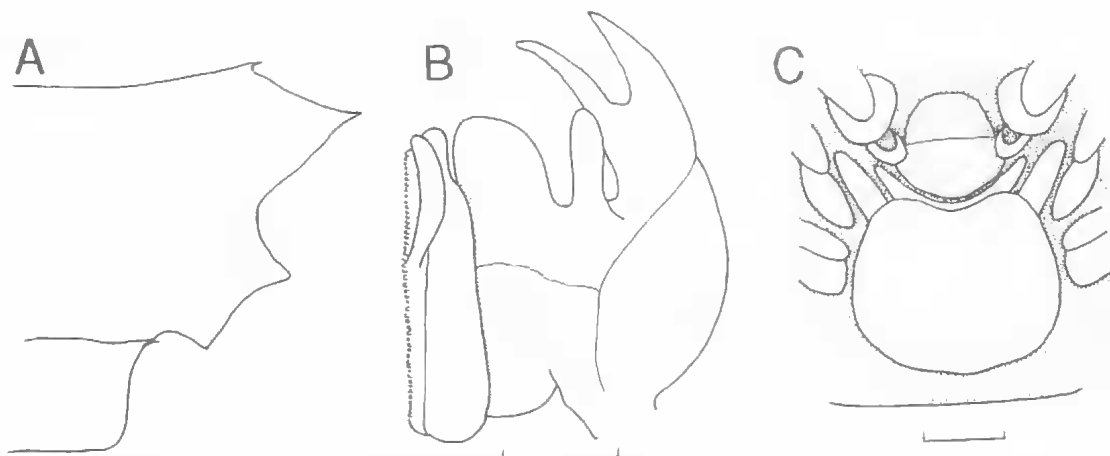


FIG. 17. *Gennadas incertus* Balss, 1927, AM P35740, 33°20'S 152°32'E, 366m. A, ♂, 7.7mm, anterior carapace; B, dorsal right half of petasma; C, ♀, 8mm, thelycum. (Scalebar = 1mm).

truncate, with rounded process bearing cincinnuli; accessory lobe a simple rounded flap not reaching as far as the internal lobe. Thelycal plate on the thoracic somite 8 hexagonal; that on sternite 7 subrectangular, with concave anterior edge, and that on sternite 7 triangular with apex directed anteriorly.

DISTRIBUTION. S Australia 32°-42°S, 550-640m, Antarctic Ocean (S of Australia, between 115°-150°E) down to 61°27'S, 0-1050m, probably mesopelagic. Known range: SE Indian Ocean, SE Australia, Antarctic Ocean, New Caledonia, SE Atlantic Ocean, 0-3400m; only recorded S of 32°S.

***Gennadas propinquus* Rathbun, 1906**  
(Fig.19A-C)

- Gennadas propinquus* Rathbun, 1906: 907, fig. 61a, b; Burkenroad, 1936:66, 83; Anderson & Lindner, 1945: 295; Percy & Forss, 1966: 1137; Kensley, 1969: 167, fig. 9; Aizawa, 1974: 24, figs 17-19; Crosnier, 1978: 38, figs 16b, 18d-e, 1989: 41, 1994b: 369; Hayashi, 1984a: 142, fig. 66h; Liu & Zhong, 1986: 60, fig. 25; Kensley et al., 1987: 278.
- Gennadas clavicarpus* de Man, 1907: 144 [part], 1911: 19 [part], 1913: pl. 1, figs 3, 3a-c, pl. 2, fig. 3h,j, 1922: 3, pl. 1, fig. 1; Balss, 1927; Boone, 1930: 129, pl. 45 (♀ only); Tirmizi, 1960: 353, figs 40c, 48c, 58-66; Kensley, 1971: 278, fig. 4; Griffiths & Brandt, 1983: 179.
- Gennadas alcocki* Kemp, 1910: 174, pl. 13; 1913: 62, pl. 7 (♀ only).
- Gennadas scutatus* Kemp, 1910: 178, pl. 13, figs 9, 10.
- Gennadas scutatus indicus* Kemp, 1913: 62 (♂♂ only).

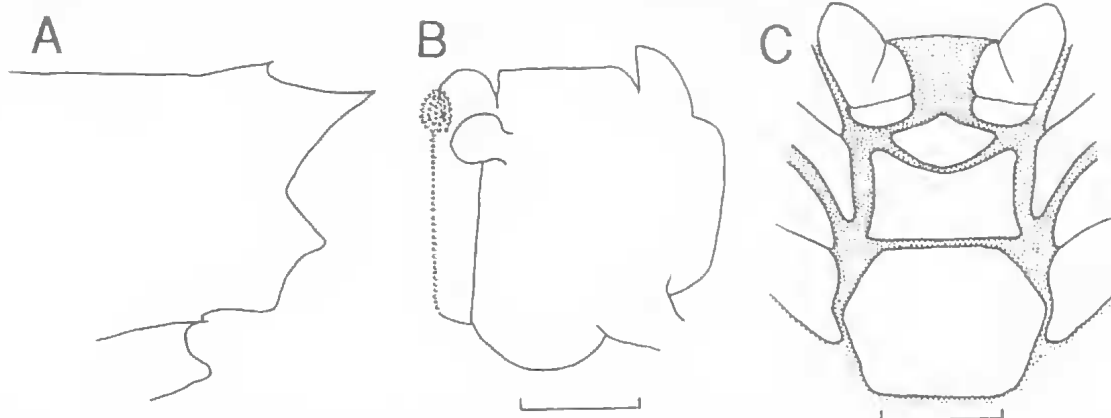


FIG. 18. *Gennadas kempii* Stebbing, 1914, AMP32915, 33°19'S 152°25'E, 640m. A, ♂, 10.1mm, anterior carapace; B, AMP32914, 33°31'S 152°20'E 550m, ♂, 9.1mm, dorsal right half of petasma; C, ♀, 8mm, thelycum. (Scale bar = 1mm).

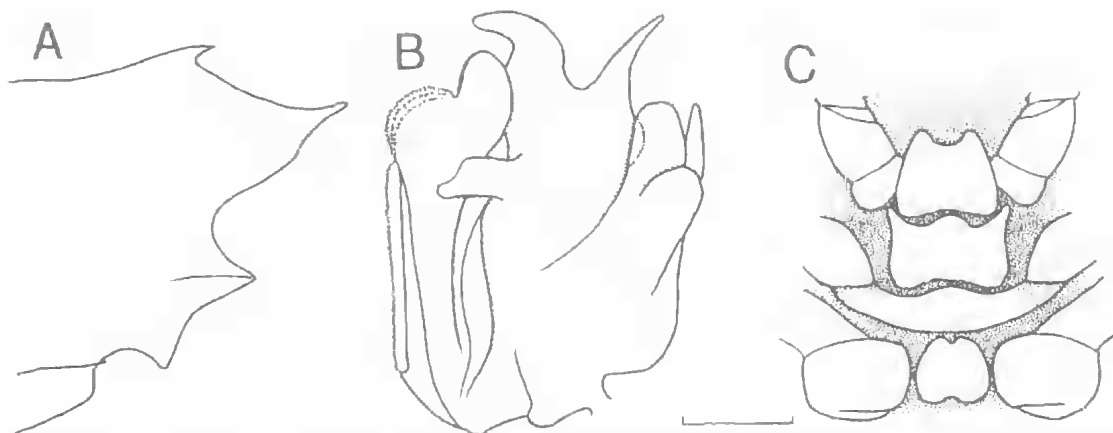


FIG. 19. *Gennadas propinquus* Rathbun, 1906 AM P32904, 33°20'S 152°32'E, 366m. A, ♂, 9.5mm, anterior carapace; B, dorsal right half of petasma; C, AM P32903, 33°17'S 152°31'E, 92m, ♀, 8.25mm, thelycum. (Scalebar = 1mm).

*Amolopenaeus scutatus indicus* Balss, 1927: 259, fig. 13.  
*Amolopenaeus clavicularis* Balss, 1927: 267.

MATERIAL. AMP32903, 33°17'S 152°32'E, 92m, 3, 6.2mm, 5♀, 5.1-8.2mm; AMP32904, 33°20'S 152°32'E, 366m, 5♂, 5.4-9.5mm.

**DIAGNOSIS.** Antennal and infra-antennal angles blunt. Petasma with the 3 lobes divided apically; the outer lobe with outer lobule acute and slender, inner lobule rounded; median lobe with both lobules prominent, apically acute; inner lobe with both lobules rounded, with cincinnuli; accessory lobe a simple flap. Thelycum with ovate plate on the sternum of thoracic somite 8, slightly indented anteriorly and posteriorly; thoracic somite 7 with a w-shaped plate, closely applied to the sub-triangular plate of the somite 6; the latter with indented anterior apex, openings of seminal receptacles at its base.

**Colour.** Body generally red, paling towards the anterior and posterior regions; thoracic appendages 2-5 dark red with purplish spots; pleopods pale red with dark purple spots at the base of each.

**REMARKS.** Griffiths & Brandt (1983) record this species (as *G. clavicularis*) at the edge and inside a warm core eddy in the Tasman Sea, but it was not abundant.

**DISTRIBUTION.** E Australia, 17°-42°S, 150-950m. Known range: Indian Ocean, Arabian Sea, Gulf of Aden, Philippines, China Sea, NW Pacific, SE Australia, New Caledonia, Wallis and Futuna Islands, E Pacific, SE Atlantic, 0-1200 m; mesopelagic migrating from deeper water at night to 100-200m.

***Gennadas scutatus* Bouvier, 1906**  
 (Fig. 20A-C)

*Gennadas scutatus* Bouvier, 1906b: 748; 1906d: 5, 9-12, figs 8, 13, 1908: 42, pl. 8, figs 1-16; Milne Edwards & Bouvier, 1909: 193, figs 10-12; Kemp, 1909: 27, 727, pl. 75, fig. 2, 1913: 61 (♀ only); de Man, 1911: 6, 15; Lenz & Strunck, 1914: 310, 341; Calman, 1925: 4; Burkenroad, 1936: 83, fig. 59, 1938: 59; Anderson & Lindner, 1943: 295; Barnard, 1950: 634, fig. 1180-p; Tirmizi, 1960: 342, 346, 357, 358, figs 40c, 48d, 67-69; Belloc, 1961: 8; Crosnier & Forest, 1969: 549; 1973: 281, figs 94a, 95a, b, 1973: Roberts & Pequegnat, 1970: 39, fig. 3-1A; Kensley, 1971: 288, fig. 10, 1972: 12, 16, fig. 4d, 6g; Aizawa, 1974: 26, fig. 20; Crosnier, 1978: 43, fig. 17a, 1984: 20, 1994b: 369; Griffiths & Brandt, 1983: 179; Kensley et al., 1987: 279.

*Gennadas clavicularis* de Man, 1907: 145 [part], 1911, 19 [part], 1913: pl. 1, fig. 3f, g, pl. 2, fig. 3k; Boone, 1930: 129 (♂ only).

*Amolopenaeus scutatus* Balss, 1927: 258, figs 11, 12.

MATERIAL. AMP32913 33°17'S 152°31'E, 92m, ♂, 6.6mm.

**DIAGNOSIS.** Antennal and infra-antennal angles acute. Petasma with external lobe divided into 2 short rounded lobules; median lobe with slender outer lobule, the inner lobule broad with a small accessory lobule on its outer margin; internal lobe divided into 2 rounded inward-facing lobules, covered with cincinnuli; accessory lobe a simple triangular flap. Thelycal plate on thoracic somite 8 with a wide rounded anterior flap extending to cover about half sternite 6; sternite 6 thelycal plate triangular, with paired seminal receptacles at its base; sternite plate 7 a wide, flattened triangle; coxae of pereopod 4 with 4-5 inwardly-directed stout setae.

**Colour.** Uniformly red.

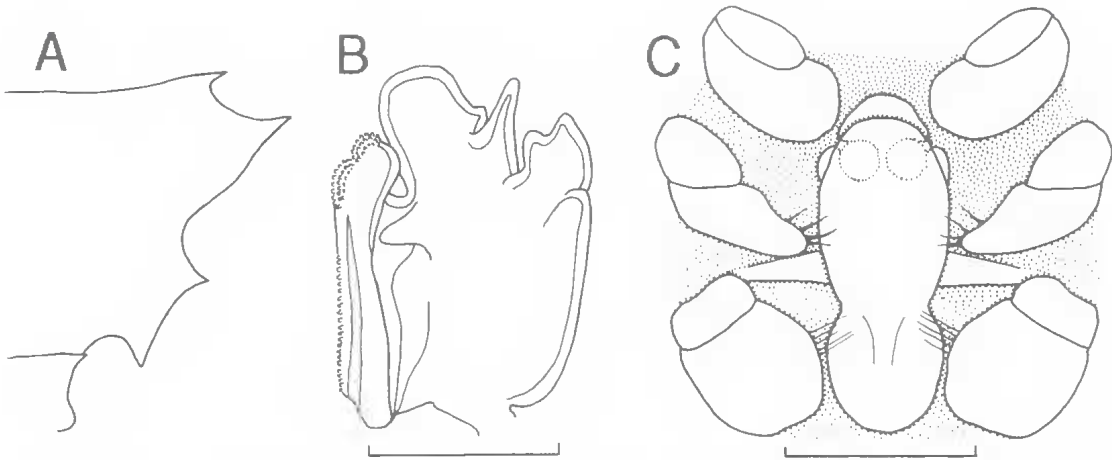


FIG. 20. *Gennadas scutatus* Bouvier, 1906, AMP32913, 33°17'S 152°31'E, 92m. A, ♀, 6.5 mm, anterior carapace; B, ♂, 5.3mm, dorsal right half of petasma. C, ♀, 6.5mm, thelycum. (Scale bar = 1 mm).

REMARKS. Griffiths & Brandt (1983) recorded *G. scutatus* on the edge of a warm-core eddy in the Tasman Sea, but it was uncommon.

DISTRIBUTION. E Australia 17-38°S, 92-1192m. Range: throughout Indo-West Pacific, E Pacific and Atlantic Oceans, 0-3400m, mesopelagic.

***Gennadas tinayrei* Bouvier, 1906**  
(Fig. 21A-C)

*Gennadas Tinayrei* Bouvier, 1906d: 10, figs 2-4, 14; 1908: 48, pl. 1, fig. 4, pl. 10; 1922: 10; Burkenroad, 1936: 73, fig. 56.

*Gennadas tinayrei* Lenz & Strunck, 1914: 313; Sund, 1920: 29; Anderson & Lindner, 1945: 293; Tirmizi, 1960: 367, figs 40f, 81-83; Kensley, 1971: 290, fig. 12, 1972: 12, figs 4b, 5c; Abbes & Casanova, 1973: 67; Aizawa, 1974: 27, fig. 21; Crosnier, 1978: 44, figs 17b, 19d; Hayashi, 1984b: 143, fig. 66k, l; Kensley et al., 1987: 279.

*Amalopenaeus tinayrei* Sund, 1920: 29.

*Amalopenaeus Tinayrei* Balss, 1927: 252, fig. 2.

MATERIAL. AMP32889, 33°31'S 152°20'E, 550m, ♂, 6.2mm; AMP52827, 34°05'S 151°55'E, 950m, ♂, 6.3mm; 3♀, 7.1, 7.2, 7.3.

DIAGNOSIS. Antennal and infra-antennal angles acute. Petasma with external lobe slightly indented, edged with minute teeth and with a small lobule at its base; middle lobe broad and slightly convex; inner lobe with 2 rounded projections covered with cincinnuli; accessory lobe flattened and rounded in outline. Thelycal plate on thoracic somite 8 small and subrectangular; plate on the somite 7 a wide triangle with 2 rounded processes on either side of its apex, and just anterior to these a further 2 smaller rounded proecesses on the somite 6;

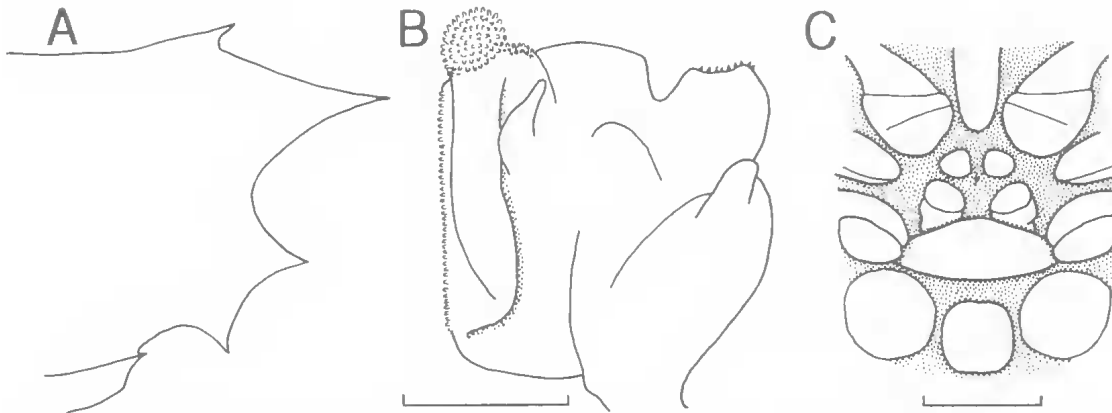


FIG. 21. *Gennadas tinayrei* Bouvier, 1906, AM P52827, 34°5'S, 151°55'E, 950m. A, ♀, 7.3 mm, anterior carapace. B, ♂, 6.3mm, dorsal right half of petasma. C, ♀, 7.3 mm, thelycum. (Scale bar = 1 mm).

sternite of the somite 5 with a posteriorly directed tongue-like process.

*Colour.* Uniformly red.

**DISTRIBUTION.** SE Australia 33-42°S, 92-950 m. Known range: throughout the Indian Ocean, SE Australia, Japan, NW Pacific, Atlantic Ocean, 92-950, probably mesopelagic and uncommon.

#### ZOOGEOGRAPHY OF THE ARISTEIDAE AND BENTHESICYMIDAE

As the Aristeidae and Benthescymidae inhabit a zone from 0-5000m, to some extent their apparent distribution reflects the collecting methods that have been used in different parts of the world by various expeditions or fishery investigations. Often only benthic collectors have been used (trawls, sledges or dredges) and pelagic or even epibenthic species have been missed or collected adventitiously during shooting or retrieval of the net. Mid-water trawls have often shown that some species hitherto considered rare, are common. The ideal approach is to use various collecting devices as described by Kikuchi & Nemoto (1991). These included an opening-closing net, a mid-water trawl, baited traps and an Agassiz-type trawl. The first 3 were the most successful in collecting *Benthescymus* and enabled Kikuchi & Nemoto to distinguish bathy- and meso-pelagic species from predominantly benthic species. It is also of interest that of the 8 *Benthescymus* species recorded, the trawl collected only *B. investigatoris* and that only once!

The depth range for most of the Aristeidae is within a 200-2000m zone, with a few reaching 5000m or more. All species of Aristeidae have well-developed pleopods and like members of other penaeoid families are probably capable of swimming appreciable distances and may swim up and down in the water column. For example, Crosnier (1978) produced evidence that *Aristaeomorpha foliacea* undergoes a vertical diurnal migration. The depth range of other species suggests that this may not be an isolated case (c.g. *Hepomadus tener*, 765-5400m).

As shown by the increasing use of mid-water trawls over the last 40 years, the Benthescymidae are largely pelagic and even those classed as benthic probably spend a large part of their time in the water column. All are small, possess thin cuticles, have well-developed pleopods and probably have low density muscle and other tissues. Although some of the species, subsequently shown to be pelagic, have been

collected in bottom trawls, it must have been while the trawl was being shot or retrieved. Pelagic (bathy-, meso- and fully pelagic) genera are *Benthonectes*, *Gennadas* and probably all species of *Bentheogennema*. *Benthescymus brevirostris* and *B. carinatus* are also pelagic (Kikuchi & Nemoto, 1991). Thus the depth range recorded for these species may range from upper levels to 5000m.

*Longitudinal distribution.* Since the Aristeidae are predominantly benthic data collected from bottom trawls probably give a realistic picture of their distribution. In contrast, unless a variety of collecting methods have been used in a given area, the apparent distribution of the Benthescymidae may not give a true picture. This is certainly the case for Australian seas. Intensive deeper water trawling and later mid-water trawling off SE Australia has collected 8 species of *Gennadas*, some of which appear to be common or even abundant. None of these species had been collected in other parts of Australia until the Australian Institute of Marine Science 'Cidaris 1' expedition, which collected 4 *Gennadas* species, using various types of gear. As noted previously, of the species of *Benthescymus*, only *B. investigatoris*, *B. urinator* and a possible third species have been collected from Australian seas, but this is unlikely to be the true picture as Kikuchi & Nemoto (1991) recorded 8 species from the NW Pacific and Crosnier (1978, 1985) 8 from the western and central Indian Ocean, 5 of which were common to those of Kikuchi & Nemoto.

Given the provisos regarding collecting methods, it is obvious that the Aristeidae and Benthescymidae are generally more widely distributed than most of the remaining Penaeoidea. Of 25 species of Aristeidae 8 have been recorded in both the Indo-West Pacific and Atlantic Oceans, with *Hemipenaeus carpenteri*, *H. spinidorsalis*, *Plestipenaeus armatus* in the E Pacific as well. Of the remaining 17 species, 7 range through the Indo-West Pacific, and 10 appear to be more localised. Among the 37 species of Benthescymidae, 14 are common to both the Indo-West Pacific and Atlantic Oceans, with 12 of these common to the E Pacific as well; an additional 3 are found through the Indo-West Pacific, and 20 have a more restricted range. A 'restricted range' may be due to misidentification, limited or inappropriate collection methods, or rarity of a species.

*Latitudinal distribution.* The pelagic species of the Benthescymidae appear to have the widest

latitudinal range. In the N Pacific the pelagic *Bentheogennema borealis* has been recorded in the S Bering Sea (around 57°N) where it is a relatively abundant mesopelagic inhabitant (Butler, 1980). *Bentheogennema burkenroadi* has been collected at 52°N off the coast of British Columbia and again is relatively abundant. No other penaeoids have been recorded in this region at such high latitudes and 45°N appears to be the approximate limit for other pelagic species. In the NW Atlantic *G. elegans* has been collected up to 57°N off the Labrador shelf, while *G. valens* has been recorded at 51°N in the northeastern Atlantic off Ireland (Squires, 1990). No other benthescymid species have been collected N of about 44°N (Squires, 1990). In the Southern Hemisphere the range is comparable with that of the N Pacific. *G. kempfi* was collected S of Australia as far as 61°27'S in the Antarctic Ocean (Iwasaki & Nemoto, 1987). Various midwater collecting devices were used with oblique tows from 700-1000m to surface. *G. kempfi* was collected at 10 stations, from 2-17 per station and thus it appears to be fairly abundant even at the highest latitudes of its range. The same cruise collected *G. gilchristi* around the Sub-Tropical Convergence at 45°S, but none beyond this latitude. It seems, therefore, that the majority of pelagic Benthescymidae are restricted to a zone between 45°N and 45°S, with a few species adapted to the lower temperatures of higher latitudes. Of the benthic Aristeidae and Benthescymidae the range appears to be a little less, mostly 40°N - 40°S.

The wide longitudinal distribution of many Aristeidae and Benthescymidae may be explained by lack of geographical barriers at depths of 1000m and more. The reason that the majority are confined to 40°N - 40°S is less obvious. It has been suggested for the Solenoceridae that this is due to the larvae in the upper water column being adapted to higher water temperatures (Dall, 1999). Thus in the Southern Hemisphere as the Subtropical Convergence zone is approached around 40°S, the upper water temperatures begin to fall sharply and so limits the southern distribution of the Solenoceridae. The same mechanism appears to apply to the Aristeidae and Benthescymidae and perhaps indicates a tropical origin for these families. However, not all species range through tropical or subtropical latitudes.

One aristeid species appears to be restricted to higher southern latitudes: *Austropenaeus nitidus*. It inhabits a zone 26° - 40°S from the S Atlantic

Ocean, South Africa, across the Indian Ocean (Amsterdam and St. Paul Islands) and across S Australia, where it appears to be common. It is likely that its longitudinal range is even wider. The mesopelagic *G. gilchristi* and *G. kempfi* have a N limit similar to that recorded for *Austropenaeus nitidus* (around 30°S), except that one *G. gilchristi* has been collected at 21°S by a midwater trawl off E New Caledonia. However, the abundance of *G. gilchristi* south of 33°S in E Australian waters suggests that this may be a stray from higher latitudes.

In conclusion, it appears that deep water Penaeoidea are less subject to the geographical barriers which influence the distribution of most of those penaeoid species that inhabit the continental shelf and its outer edges. This particularly applies to the pelagic Benthescymidae many of which have a wide longitudinal range with temperature as the major north and south latitudinal limiting factor. Significantly in this regard, 2 species of pelagic *Funchalia* (Penaeidae) are also cosmopolitan.

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